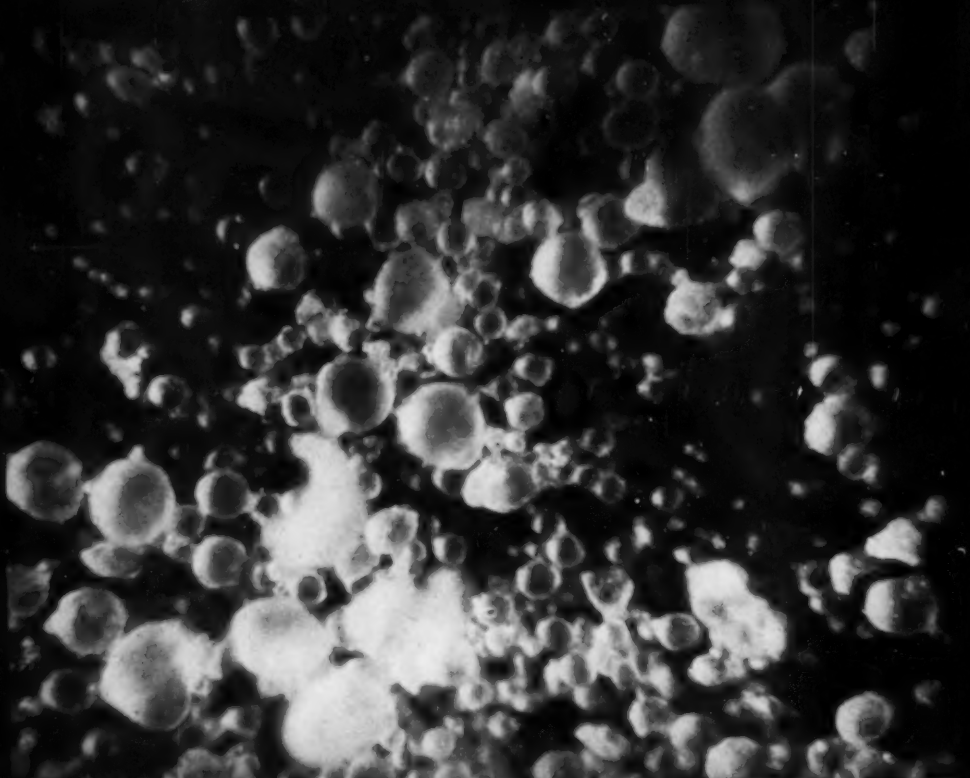
DECEMBER
1951

Chemical Engineering



CATALYSTS: THEIR SELECTION, MANUFACTURE AND RECENT APPLICATIONS. . . . . **PAGE 157**

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PROCESSES AND PRODUCTS

Chlorine Liquefaction Modernized ....H. J. Eichenhofer and V. N. Federoff 142
Catalysts ....Feature Report 157
New Cements Resist Alkali Too 196
Precision Magnesia Insulation ....Pictured Flowsheet 208
Fluorochemicals Go Commercial 215
Phosphorus On the Rise ....Commodity Survey 354
New Products and Materials.... 196

ENGINEERING AND EQUIPMENT

Process Control by Mass Spectrometer ....Charles F. Robinson 136
If Computation Costs Too Much ....J. W. Donnell 138
Cost Estimates Answer Questions ....Loyal Clarke 144
Radioactive Waste Disposal ....W. A. Rodger and Phillip Fineman 146
How to Scale Up a Rotary Kiln ....J. A. Leuthge 151
What NPSH Means in Choice of a Centrifugal Pump ....E. J. Hanson 174
Furane Cements ....Corrosion Forum 268
How Austenitic Nickel Cast Iron Can Serve As An Alternate....H. O. Teeple 286
Plant Notebook 154
Process Equipment News 176
Equipment Cost Index 178

NEWS AND TRENDS

Conditions Favorable—and Otherwise ....Editorial Foreword 135
World Chemical Race Speed Up ....Chemical Economics 349
Chementator 103
Convention Calendar 227
Editorial Viewpoints 172
News From Abroad 261
Chemical Engineering News 215
Process Industry Trends 352
New Construction 358

PEOPLE AND FIRMS

Phillips' Achievement 169
Present That Paper Effectively ....Herman W. Seinwerth 290
Memo From the Editor 133
Names in the News 298
Readers' Views and Comments 254
William I. Burt 298
You and Your Job 290
Industrial Notes 310

LITERATURE AIDS

New Technical Literature 204
Chemical Engineer's Bookshelf 337
Quotes, Extracts and Digests 314
Recent Books and Pamphlets 342
Reader Service Section ....Inside Back Cover
Annual Editorial Index.... 419

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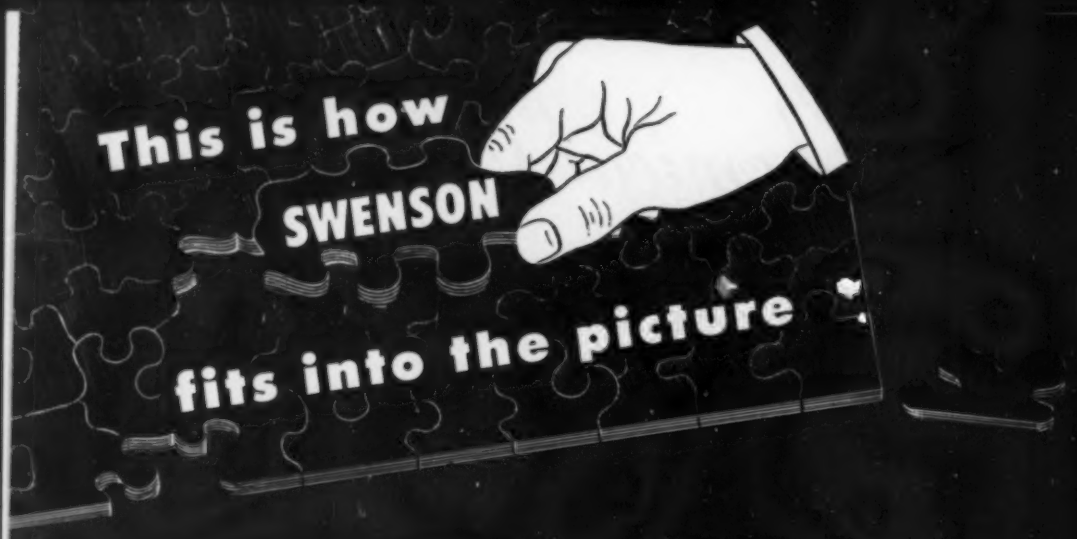

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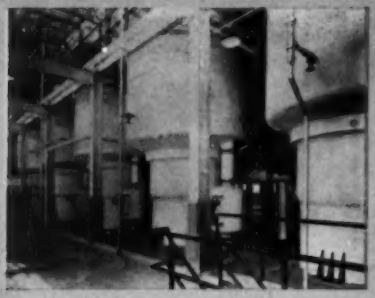
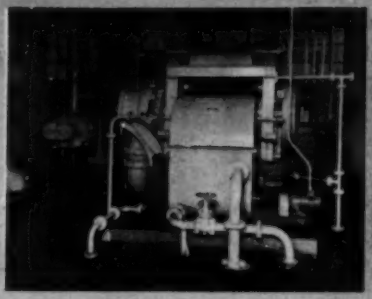
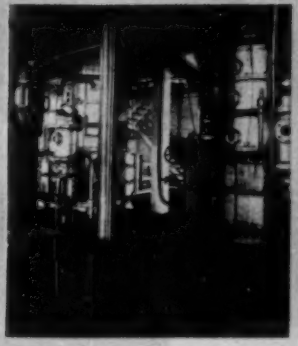


First four effects of Swenson 7-Body L.T.V. Quintuple Effect Beet Sugar Evaporator

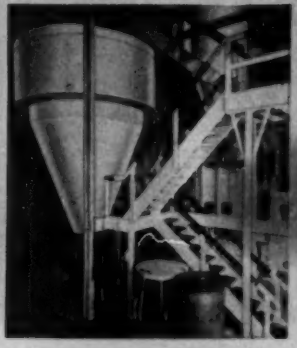


Swenson Rotary Drum Vacuum Filter used for spin bath recovery in rayon-cellophane production

Swenson Forced Circulation Evaporator used for recovering organic materials

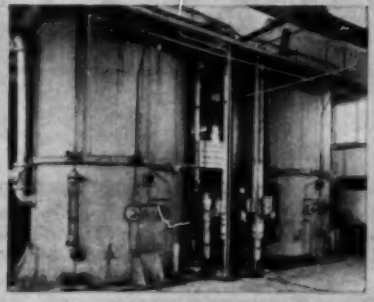


Swenson Cast Lead Evaporators used for the concentration of phosphoric acid



Swenson Spray Dryer used in manufacturing pharmaceutical products from process wastes

A battery of six Swenson-Nyman Pulp Washers used in producing kraft paper



Swenson Vacuum Crystallizers precipitate Glaubers' salt from acid solution

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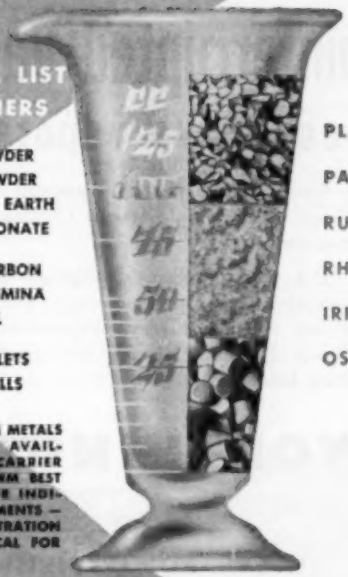

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If catalysis is a part of your production or if you are contemplating a process involving a catalytic stage, we would like to discuss the problem with you . . . to assist in developing the most efficient and economical procedure and catalyst for your production. ★ ★ ★ ★ ★ ★

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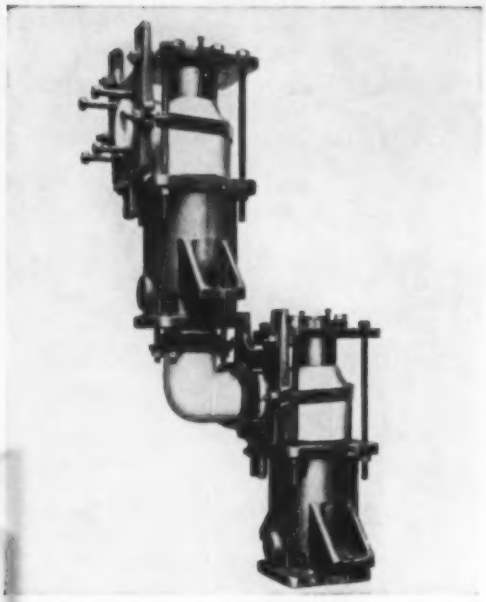
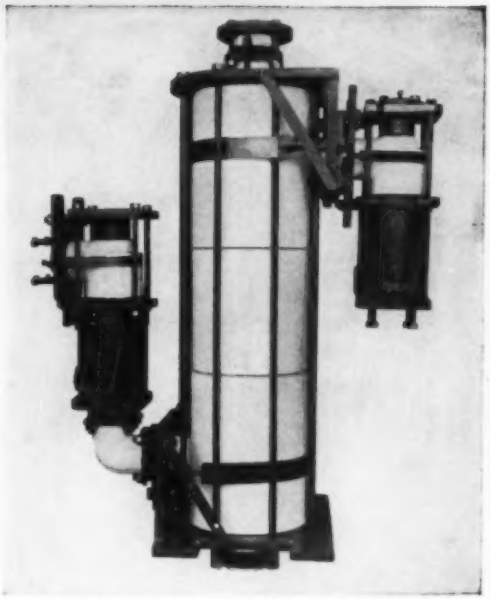


Worthington two-stage non-condensing ejector—porcelain



Worthington two-stage condensing unit—porcelain

How To Maintain an Uninterrupted Vacuum

in the presence of corrosive vapors

Use a Worthington corrosion-proof steam-jet ejector. These are made in stock sizes and specially engineered for handling any corrosive vapor problem in the chemical field.

For corrosive vapors, these ejectors are made with impervious graphite nozzles and diffusers. Suction chambers are of porcelain, but these can also be furnished of impervious graphite. Porcelain diffusers are also available.

For corrosion-*resistant* usage, Worthington makes ejectors of bronze, stainless steel or Worthite (a special Worthington "super-stainless").

Worthington's is the *most complete* ejector line. A model for every vacuum requirement —from atmospheric to 50 microns absolute. Single and multiple stages. Condensing and non-condensing.

Put your problem—distillation, drying or any other vacuum problem—up to Worthington Pump and Machinery Corporation, Steam Power Division, Ejector Section, Harrison, New Jersey.

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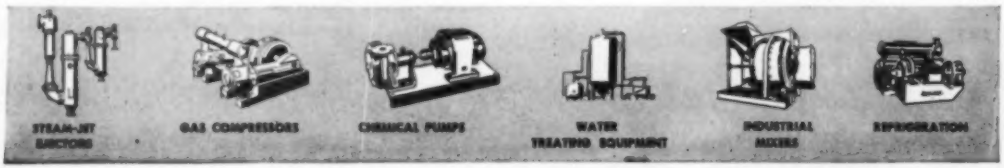
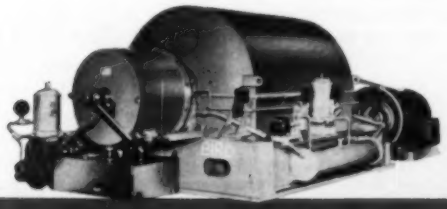


TAKE TWENTY MILLION TONS OF FINE COAL, FOR EXAMPLE

BIRD CONTINUOUS CENTRIFUGAL FILTERS have dewatered this tremendous tonnage without a hitch.

On rough, tough, heavy duty service like this BIRDS stay on the job day in and day out. Routine maintenance is done only during regular service intervals and these are months apart. Operating and maintenance cost is only a few cents per ton.

Whatever your product or tonnage there is a BIRD to do the job. It's built in a number of sizes, of materials to fit the requirements. It can give you the same kind of productivity and economy it has given the coal industry.



Representative Materials Handled by BIRD FILTERS

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Ammonium Alum
Ammonium Chloride
Ammonium Nitrate
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Barium Chloride
Barium Sulphate
Beryllium Sulphate
Black Ash
Borax
Calcium Carbonate
Carnallite
[illegible] Oxide
Coal
[illegible] Sulphate
[illegible]peras
Cryolite
Di-Sodium Phosphate
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Glaubers Salt
Glutamic Acid
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Iron Ore
Iron Oxide
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Lead Arsenate
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Lime Mud
Lithopone
Manganese Ore
Nickel Salts
Packing House Waste
Phenol
Phosphate High Grade Residue
Potassium Carbonate
Potassium Chloride
Potassium Hydroxide
Potassium Nitrate
Potassium Sulphate
Potato Starch
Sodium Bichromate
Sodium Carbonate
Sodium Chloride
Sodium Fluoride
Sodium Hydroxide
Sodium Nitrate
Sodium Stannate
Sodium Sulphate
Sodium Sulphite
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Solvent Extractions
Starches
Sulfur
Synthetic Resins
Tallow
Tartaric Acid
Tin Ore
Titanium Dioxide
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Now it's up to the boy to choose.

How will he decide? Perhaps by the look in a puppy's eye.

Chances are, you'll be buying Multiwalls soon again. You've done as every good buyer does. You've considered the reputation of the various suppliers. You've investigated the quality of their product. You've set down your specifications to the last fraction.

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Men who know Multiwalls . . . who buy more than 85 per cent of all Multiwalls made . . . give great weight* to good printing and design.

Union's art directors have concentrated experience. They know how to give your Multiwall package the look it needs to stand out among competition. Volume purchasers of Multiwalls recognize this. They are calling on Union for a greater share of their Multiwall needs.

More so every day . . .

IT'S UNION FOR MULTIWALLS

*August, 1951 research study.

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The BULK-FLO feeds . . . conveys . . . elevates, providing more profitable handling of hundreds of materials

Difficult-to-handle bulk materials are moved safely and economically with the Bulk-Flo. The Bulk-Flo, most versatile type of conveying medium on the market, serves as a feeder, conveyor and elevator under one drive. The same unit can combine horizontal, vertical and inclined paths, often replacing several units, in less space and at lower cost. Multiple feed and discharge points are practicable. It is completely enclosed—dust tight.

Operating independent of internal pressure, the Bulk-Flo, *with solid flights*, need not be operated at full capacity to provide positive movement of materials. Regardless of the amount of feed, it is self-clearing.

Bulk-Flo provides gentler handling. Because of its solid flights, there are no annoying updrafts of air. Avalanching is eliminated. Variable speed drives are not necessary, because the capacity can be varied by regulating the feed.

You can be sure, when our specialists recommend Bulk-Flo to your engineers or designing contractor, that it is the *right* conveying system for your needs, because Link-Belt makes *all types* of feeding, conveying and elevating machinery—the only complete line on the market today. For all the facts, write for Book 2175.

Full or partially loaded, Link-Belt Bulk-Flo with solid flights provides positive, gentle material handling.

Bulk material handling is easier and safer with BULK-FLO

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- Dust-tight construction.
- Handles batches on cycle operations.
- No contamination from lubrication
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- Can be made spark-proof. Slow operating speed reduces possibility of sparking.
- Suitable for hazardous areas. Liquid and vapor-tight, to handle volatile materials. Drives can be furnished with explosion-proof motors.

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Cut Cooling Costs *these 3 Ways*

1. CUTS INSTALLATION COSTS

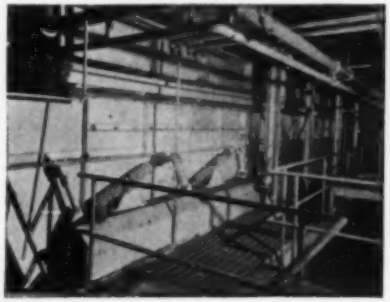
The air-quenching grate cooler comes as a complete unit, fits into existing plants readily because it operates horizontally. Installation costs are 10 to 30 percent less than the cost of installing any other type of cooler! Kiln piers need not be elevated . . . no pit is required beneath kiln.

2. CUTS MAINTENANCE COSTS

Reciprocating motion of grate is carried on flexible rubber bushings and springs. No wearing parts and no slippage. Material does not slide on grate, it hops, gently and steadily. Lubrication is negligible, only four grease fittings on entire cooler. Maintenance cost runs as low as 1/10 cent per barrel.

3. CUTS ROTARY KILN FUEL COSTS

Air-Quenching grate cooler actually returns 75% of sensible heat in material back to kiln as secondary combustion air. Material is cooled quickly, to a temperature where handling is no problem, by means of cooling air coming up through the relatively thin bed of hot material on grate.



4½ by 70 ft Allis-Chalmers air-quenching grate cooler installed in processing plant where it cools large quantities of material from 2500° F to approximately 150° F.

Handles Fine or Coarse Materials

Both fine and coarse materials can be cooled equally well. Need for a supplementary conveyor under cooler is eliminated. Pan conveyor can be added on cooler without need for an additional drive. Get more facts from the Allis-Chalmers representative in your area, or write for Bulletin 07B6368A. Allis-Chalmers, Milwaukee 1, Wisconsin.

Pulverator is an Allis-Chalmers trademark.

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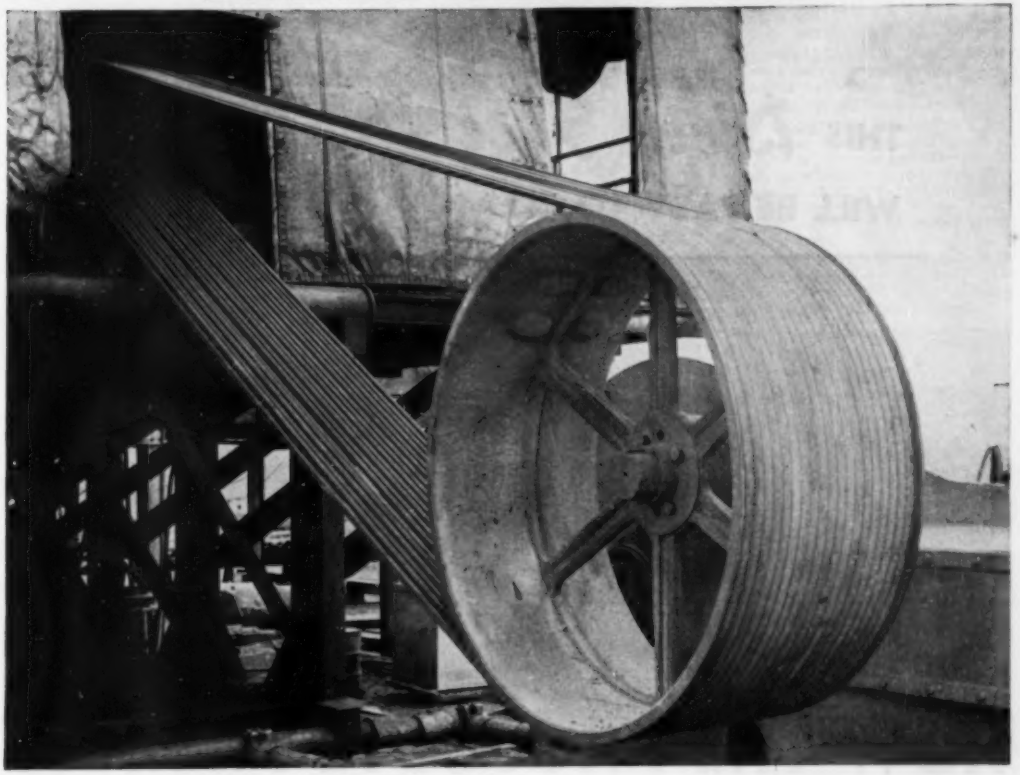

Here B. F. Goodrich grommet belts are saving $104.50 a month

B. F. Goodrich grommet V belts cut costs 20 to 50%

THESE 18 V belts are needed to drive heavy pumps for drilling oil wells. The belts have to operate 24 hours a day, 7 days a week, in all sorts of weather. Ordinary belts couldn't stand the heavy pulling load, couldn't take the strain of round-the-clock operation. They averaged 9 months' life in this kind of service.

Then B. F. Goodrich grommet belts were tried. After 19 months, and drilling wells totaling 76,000 feet deep, these grommet belts look as good today as the day they were installed. Here's why B. F. Goodrich grommet belts can be counted on to save on belt costs:

No cord ends — A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength — All of the cord material in a B. F. Goodrich grommet multiple-V belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. No layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced.

Better grip, less slip — Because a grommet is endless, a grommet V belt is more flexible, grips the pulleys better. Size for size, grommet multiple-V belts will give ⅓ more gripping power, pull heavier loads with a higher safety factor.

Only B. F. Goodrich has the grommet!—No other multiple-V belt is a grommet V belt (U. S. Patent No. 2,233,294). Now available in C, D and E sections. See your local B. F. Goodrich distributor. *The B. F. Goodrich Company, Industrial & General Products Division, Akron, Ohio.*

Grommet V Belts BY

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RUBBER FOR INDUSTRY

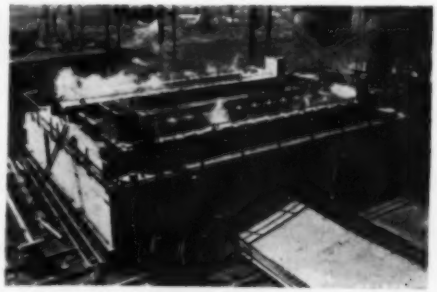
HOW THE PHOSCOTE PROCESS

brings new painting economies to the Chemical Industry

Contrary to appearances, this Hortonspheroid can be quickly cleaned, spot-primed and painted. No long hours of manually removing mill scale from its steel surfaces are necessary. The mill scale has already been removed at our plant by the Phoscote Process. A prime coat of special paint was applied while the steel was still warm.

The Phoscote Process is a proven method of cleaning and preparing the surfaces of steel plates and shapes. All mill scale is thoroughly removed. A protective coating of iron phosphate is deposited on the surface of the metal to retard rust and provide a better bond for paint. As a result, structures built of steel, pickled and painted by the Phoscote Process need only be cleaned and spot-primed before the final coats of paint are applied.

Get these time and money saving advantages when you order Horton tanks. Specify the Phoscote Process.



Steel plates being pickled and painted by the Phoscote Process at our Birmingham plant.

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Detroit 26.....1503 Lafayette Bldg.
Houston 2.....2103 National Standard Bldg.
Los Angeles 17..1505 General Petroleum Bldg.
New York 6.....3319—165 Broadway Bldg.
Philadelphia 3..1625—1700 Walnut St. Bldg.
Salt Lake City 4....505 West 17th South St.
San Francisco 4.....1522—200 Bush St.
Seattle 1.....1305 Henry Bldg.
Tulsa 3.....1623 Hunt Bldg.
Washington 6, D. C.....1160 Cafritz Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

ALOYCO No. 1105 gate valve fully jacketed for heating valve.

Lasts longer in corrosive service

If the application is on a line carrying corrosive liquids, a high alloy valve will save you time and trouble. ALOYCO specializes on high alloy valves with

A. metallurgical research devoted *exclusively* to corrosive applications;

B. foundry and machine shop facilities set up for high alloy valves *only;*

C. casting and machining practices dictated by the difficult characteristics of the alloys required for corrosive services.

Success Stories from ALOYCO'S Corrosion Clinic

THE CORROSIVE: Asphalt resin.

THE APPLICATION: Sampling high-temperature, high-viscosity asphalt resin in processing of lubricating oil.

THE PLACE: A large oil refinery.

THE PROBLEM: Standard cast iron gate valves, traced with a 150 psi steam coil, did not provide uniform heating, which gave trouble in sampling. They became loaded with asphalt, which caused them to stick. When finally opened, a solid slug of asphalt would come through.

THE SOLUTION: ALOYCO fully jacketed gate valves. Valve body and bonnet jackets are connected to 150 psi steam and valves are completely lagged.

Steam-jacketed ALOYCO valve insures free-flowing asphalt resin sample.

THE RESULTS: ALOYCO valves have been in service since 1948, and are used daily for sampling. Since valve is heated uniformly in body and bonnet, the asphalt flows freely and sticking is eliminated.

THE BACKGROUND: The ALOYCO Corrosion Clinic offers aid on all sorts of problems—not just corrosion. If the service is one that should be handled by a corrosion-resistant valve, the problem—whether it be corrosion, contamination, discoloration, temperature extremes or proper application—is one for the Clinic.

Among all valve manufacturers, ALOYCO is the *largest* specializing in high alloy valves. We make *more* corrosion-resistant valves than anybody else.

Cut valve costs. Put your problem up to ALOYCO'S Corrosion Clinic.

ALLOY STEEL PRODUCTS CO., INC.
1301 West Elizabeth Avenue, Linden, N. J

Longer Lasting

ALOYCO VALVES

1st in Corrosive Service

Efficient Exhaust and No Space Wasted

"Buffalo" VANEAXIALS MOUNTED IN VERTICAL EXHAUSTS

ROOF INSTALLATION OF PAPER COMPANY POINTS WAY TO SAVINGS IN MANY INDUSTRIES

Above are part of the ten 36" "Buffalo" Type "B" Vaneaxial Fans mounted in roof exhausts of West Virginia Pulp and Paper Co., Mechanicville, N. Y. Note how the fans fit in like a section of pipe. Their light weight obviates heavy, expensive mountings, and the fans waste no space. The steam comes from hoods from Nos. 5 and 6 paper machines — and passes straight through the pipes and fans with absolute minimum resistance. (At right, note how motor is entirely removed from air stream). Whenever YOU need fans for mounting in straight duct runs, you'll save money with "Buffalo" Vaneaxials!

YOURS! This Helpful Bulletin No. 3533-C! Describes "Buffalo" Axial Flow Fans and their uses. Write for your copy!

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

501 BROADWAY, BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch offices in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

Check Your Hose Needs–

and answer most of them with

GOODYEAR INDUSTRIAL RUBBER PRODUCTS
GTM -Specified ORTAC HOSE
for Universal Use
A
B
C
A Cover resists weather, oil, sun, abrasion.
B Braids of high-strength rayon cord.
C Synthetic tube resists gasoline, oils, distillates and alkalies.
ORTAC (Oil Resistant Tube and Cover) hose is available in sizes from 3/16" to 1½" in long, continuous lengths. Factory application of couplings if desired.

ORTAC

GOODYEAR's ORTAC hose (Oil Resistant Tube and Cover) simplifies your hose-buying problems. For this *one construction* was designed by the G.T.M.—Goodyear Technical Man — to perform *many* assignments.

ORTAC will handle gasolines, fuel oils and distillates. It resists attack from alkalies, as well as the contaminants found in water. Excellent, too, for air and spray service. Its cover resists sun, weather and wear — ORTAC has a tube which will not flake, swell or discolor. Available in long, continuous lengths.

Ask your nearest distributor for full details on ORTAC—or write Goodyear, Akron 16, Ohio.

FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

GOODYEAR

THE GREATEST NAME IN RUBBER

We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

Ortac–T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

DO YOU NEED A DEPENDABLE SOURCE OF

Formaldehyde?

Look to CELANESE* N. F. FORMALDEHYDE

Here's why it gives you top quality at lower cost:

- Celanese is one of the largest producers of Formaldehyde in the world.
- Production is by oxidation method—using natural gases as raw material.
- Production not dependent on supplies of Methanol.
- Celanese distribution service—by tanker, tank car, tank truck, or drum.
- Terminals and distribution points in strategic locations assure prompt deliveries.
- Nationwide distributor service also means prompt handling of your less-than-carload requirements.

Celanese® CHEMICALS

*Reg. U.S. Pat. Off.

REVISED FORMALDEHYDE TECHNICAL MANUAL

Write now for the revised technical manual on Formaldehyde—37 pages of detailed information, including a special 4-page section on Formcel* (Formaldehyde-alcohol solutions). Celanese Corporation of America, Chemical Division, Dept. 503-L, 180 Madison Avenue, New York 16, New York.

ACETIC ACID • ACETALDEHYDE • FORMALDEHYDE • PARAFORMALDEHYDE • ACETONE • BUTYL ALCOHOLS • METHANOL
NORMAL PROPANOL • BUTYLENE GLYCOLS • DIPROPYLENE GLYCOL • PROPYLENE GLYCOL • PROPYLENE OXIDE • TRICRESYL PHOSPHATES

...from billet to tube to fitting

From this modern control room, every step in the heating, piercing, rolling and reduction of seamless tubes is closely monitored. This is typical of the highly specialized equipment demanded by the Globe precision process . . . insuring high quality and close tolerances.

GLOBE highly specialized process controls are used to produce the finest in WELDING FITTINGS

For complete information on the finest welding fittings available anywhere, send for the Globe Welding Fittings Catalog.

Globe precision-process manufacture *begins with the billet* — continues through the making of the seamless steel tube — (Globe alone among welding fitting manufacturers produces seamless steel tubes) — and extends through to the production of the finished fittings.

Because Globe has highly specialized controls — at every stage of manufacture *in its own plant* — you can be sure of uniform high quality seamless welding fittings when you specify Globe.

GLOBE STEEL TUBES CO.
MILWAUKEE 46, WISCONSIN

Chicago, Cleveland, Detroit, New York, Philadelphia, St. Louis, Denver, Houston, San Francisco, Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.

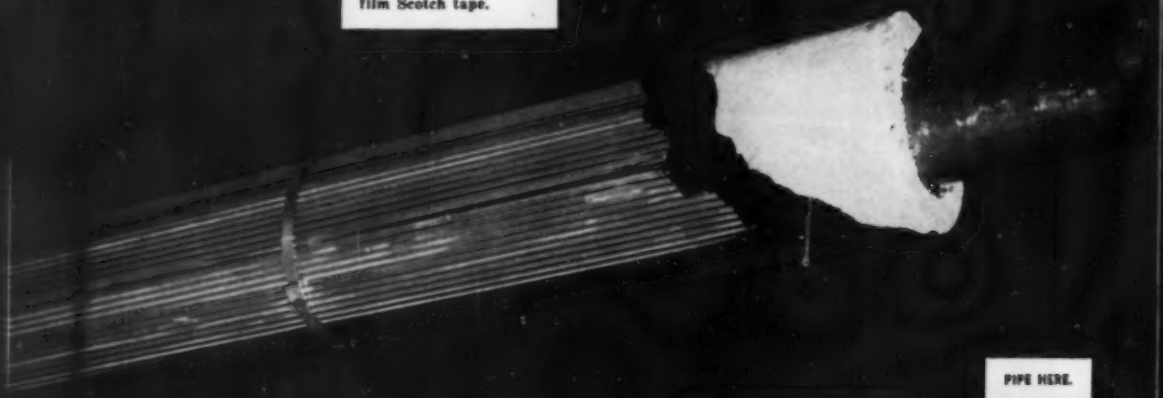
Save money—cut maintenance with

NO PAINTING . . . aluminum always retains its new look — needs no expensive periodic repainting.

GOES ON FAST . . . no roll forming . . . no expensive shearing. Fasten with aluminum strapping and seals, sheet metal screws or plastic film Scotch tape.

THIS MOISTURE barrier — an exclusive Childers feature — protects aluminum from corrosion on inside of jacketing. It is factory-attached to the jacketing.

CUT-AWAY SHOWS how jacketing goes on right over the insulation. Can help hold insulation in position.



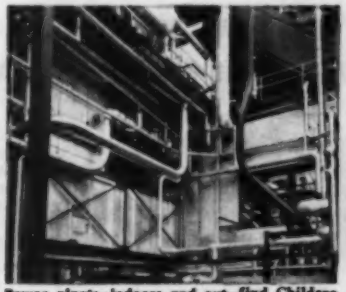
PIPE HERE.

USE OVER ANY type of moulded insulation.

This is the lowest cost of any permanent metal jacketing. The corrugated aluminum provides strong, durable protection with three way savings: (1) Low maintenance costs; (2) Lower first cost than other permanent jacketing; (3) Lowest application costs because it is easy to cut, handle, and attach.

Childers Jacketing already in use in 567 of America's leading processing plants.

Oil refineries and gasoline plants had started to use sheet aluminum for protecting insulated lines even before Childers Jacketing was developed. They were tired of costly maintenance and repair with temporary materials. Now they are discovering that Childers Jacketing has even more advantages than expensive sheet aluminum—but costs less to buy and far less to apply.



Power plants—indoors and out—find Childers Jacketing their ideal material for protecting insulated lines as in this big Southern installation. Childers Jacketing is low in cost and easy to handle. More than that, it is a permanent-type weather protection that needs no painting. Its gleaming aluminum surface makes for "good housekeeping" in any utility or industrial power station.

Chemical and food plants such as this plant of the Minute Maid Corp. at Leesburg, Florida, like the low cost, low maintenance, and neat appearance of Childers jacketing. Indoors in food plants aluminum maintains that spotless look and can easily be washed. Outdoors in the tough corrosive atmosphere of most chemical plants the 3S alloy used for Childers Jacketing gives maximum life.

Childers Jacketing for insulated lines

Easy to apply—Childers Jacketing cuts man-hours

1. This is how easy it is to cut and handle Childers Jacketing right on the job. The four-foot-wide roll can be run out and cut to lengths by one man using a dull knife and a straight-edge. This cuts preparatory labor.

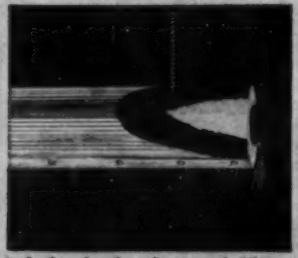
2. Best method of attaching jacketing is with aluminum strapping and seals. Here a seal is placed on end of strap, preparatory to putting it around the jacketing. This can all be done easily by hand; no tool or machine needed.

3. A two-man crew can apply the jacketing fastest. No special shop work or roll forming is necessary. Only tools are a pair of pliers and a wedge or screw driver as shown here. Note how easily the jacketing forms around the pipe.

4. Aluminum strapping can be pulled plenty tight enough with just pliers like this. No special strapping tool needed. Wooden wedge is useful substitute for screw driver. Strapping is next pulled down between lugs.

5. Lugs are bent over easily, but hold strapping securely and permanently in position. If line is moved, lugs can be bent up to release strapping. Seals, strapping, and jacketing itself can be re-used in this case.

6. Strapping is snipped off to make a neat job, and the workman is ready to go on to the next strapping point. Minimum number of straps hold flexible Childers Jacketing firmly and snugly in place.



Two alternate methods of attaching the jacketing involve the use of (1) Minnesota Mining's No. 471 Plastic Film Scotch Tape; or (2) aluminum sheet metal screws. All methods are satisfactory; but aluminum strapping and seal method is probably best all-around.

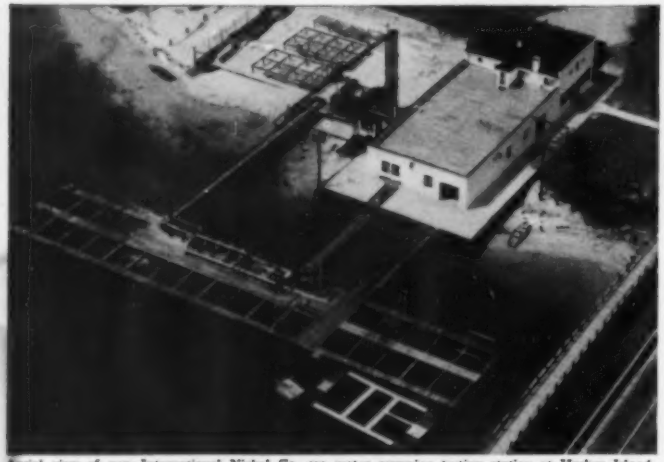
There are Childers Engineering representatives in every principal city. They are anxious to help you with your jacketing problem. Write for name of engineering representative nearest you. Address Childers Manufacturing Co., Dept. CS-2, 625 Yale St., Houston 7, Texas.

CHILDERS
ALUMINUM WEATHER-PROOF
Jacketing

BRIDGEPORT BRASS COMPANY
CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN

"Bridgeport" MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL



Aerial view of new International Nickel Co. sea water corrosion testing station at Harbor Island, Wrightsville, North Carolina.

Kure Beach Tests Help Lengthen Condenser Tube Life

Sea water corrosion testing of copper-base alloys continues to be an important phase of Bridgeport's Research Program. This work was originally started at the International Nickel Company's sea water corrosion test station at Kure Beach, North Carolina. It is now being carried on at Harbor Island, Wrightsville, North Carolina. During the past 8 years Bridgeport has tested thousands of metal samples.

Many test conditions closely approximate the "in-use" environments of condenser tubing installed in surface condensers operating with circulating sea water. Test samples are suspended in clean sea water flowing at a velocity of approximately two to three feet per second with a water temperature ranging from 35° to 85° F.

Test Procedure

Representative control samples were physically and chemically tested. Before assembly in special test racks, each sample was carefully annealed, cleaned, weighed and measured. The test racks were then submerged approximately 15 inches below the surface of the water.

At regular intervals (approximately 6 months) the test racks are removed for visual inspection and several are taken to the laboratory where they are dismantled for cleaning, weighing, inspecting, testing, and calculation of the rates of corrosion.

Results Found Helpful

Much valuable information was gained which has proved helpful in selecting copper-base alloys for sea water applications. We have been able to study impingement corrosion and the effects of alloy changes on pitting associated with impingement corrosion, and general surface pitting. We have also observed the extent and depth of corrosion based upon weight loss and loss in tensile strength, and the effect of metal hardness or temper on corrosion rate.

Since the results of the tests revealed those alloys with the greatest resistance to biofouling and corrosion in sea water, we have been able to improve them by modifying the amount of various alloying materials.

Improving Resistance To Impingement Corrosion

For example, one of the first things noted in connection with the test specimens was that the appearance of the leading edges varied considerably from one alloy to another. It was found that some of the specimens lost their sharp edges (see Fig. 1) and took on a rounded appearance. Those alloys which were most worn on the leading edge also had bright, clean leading edges without any visible corrosion film in this area. This led to a very marked decrease in the width of the specimens, and since the trailing edge of these specimens suffered very little change, the depth of corrosion on the leading edge could be measured directly with a micrometer.

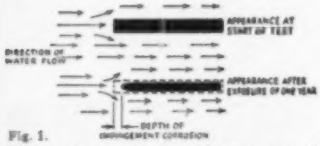

APPEARANCE AT START OF TEST
DIRECTION OF WATER FLOW
APPEARANCE AFTER EXPOSURE OF ONE YEAR
DEPTH OF IMPINGEMENT CORROSION

Fig. 1.
Diagram showing the change in appearance of the leading edge of specimens due to impinging stream of sea water.

The final width of the specimen subtracted from the original width was called the depth of impingement corrosion. These measurements revealed that the following alloy changes led to marked increases in resistance to impingement corrosion:

(1) the combined addition of 5% aluminum and 0.25% arsenic to copper;

(2) the combined addition of 5% tin and 0.1% phosphorus to copper;

(3) the addition of approximately 0.5% iron to 70-30 cupro nickel;

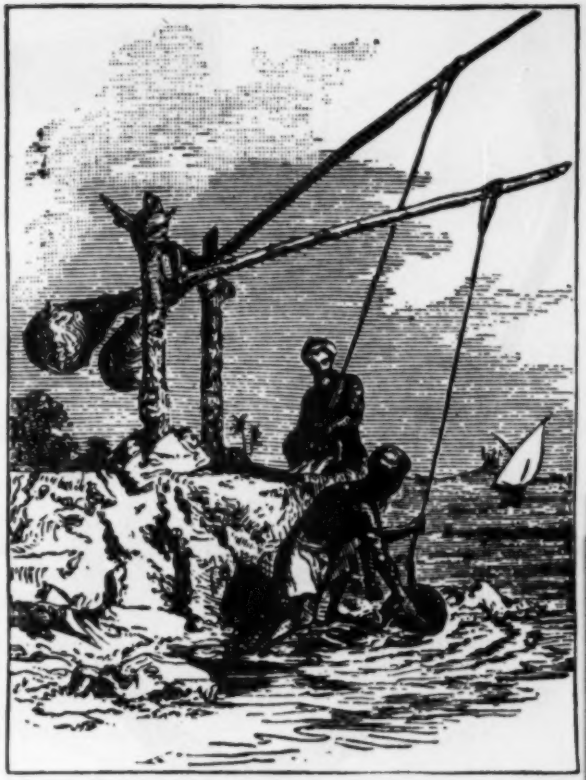
(4) the addition of 2% aluminum and 0.02% arsenic to 75-25 copper-zinc alloy.

The addition of arsenic or tin to Muntz Metal increased the rate of impingement corrosion. It is evident that, while uniform dezincification is in progress (as in the 60-40 brass, Muntz Metal), no impingement corrosion occurs. This indicates that the dezincification reaction overpowers the impingement corrosion reaction.

Additional information is constantly being gleaned from sea water tests. This is considered in conjunction with the results of other research carried on by the Bridgeport Laboratory to assist in getting longer service life from condenser and heat exchanger tubing.

(7583)

The Pump that wasn't a pump



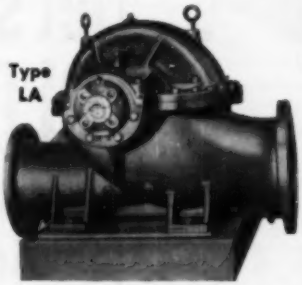
For many years this peculiar looking contrivance was the most efficient means known for moving water from one level to another—but it wasn't really a pump, it was a "shadoof".

Though still used today in many parts of the world, this hand-operated "bailing lever" is said to have been used 3000 years ago by the ancient Babylonians. On the basis of six strokes a minute, with a bucket that held 60 pounds of water, it could raise 36 gallons per minute. Those "bags" on the short end are used as counterpoises to lift the filled vessels.

If this were 3000 BC and you were looking for a pump for *any* purpose, the best Worthington could do for you would be to recommend a shadoof. The drive? Only *one* available—a husky slave.

Almost fantastic, isn't it, that crude devices like the shadoof, the mechanical innovations of their day, were the starting points for modern Worthington pumps—centrifugal pumps that can move as much as 250,000 gallons per minute; individual designs with 100,000 standard combinations of capacities, heads, casings, and mountings for *any* drive available; single-stage, multi-stage, volute, turbine, horizontal, vertical, Mixflo, Axiflo and regenerative pumps—for virtually every need of utilities, petroleum, paper, sugar, food, chemical, marine, water works, metal-working, and many other industries.

Yes, there's a Worthington pump for your requirement—a pump that's *standard* with Worthington. To find out about it, consult your nearest Worthington District Office or write to Worthington Pump and Machinery Corp., Centrifugal Pump Div., Harrison, N. J.

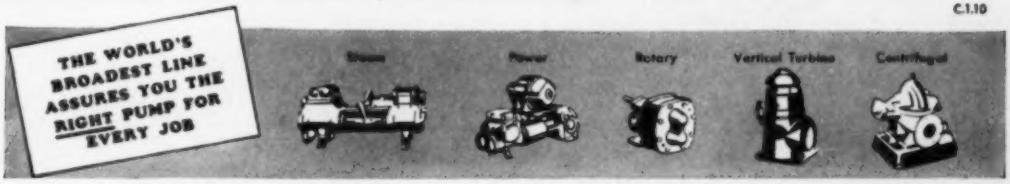


When you buy Worthington centrifugal pumps—the most complete line you'll ever find—you'll always be assured of the *right* pump for every job. Typical of this broad Worthington line is this large LA (to 60,000 gpm) at left; monobloc DN pump (to 2500 gpm), center; and the CN, frame-mounted version of the DN, in over 10,000 combinations.

WORTHINGTON

C-1.10

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



... let's take a
CLOSER LOOK at
STRAIGHT-CHROMIUM
Stainless Steel Tubing

Present restrictions on nickel have cut production of austenitic stainless steel tubing far below demand. If this critical shortage of nickel-bearing stainless tubing is compelling you to find other suitable grades, you should take a closer look at the straight-chromium analyses.

Readily available in quantity from B&W are pipe and tubes of the four non-nickel-bearing types listed below with typical uses. These ferritic and martensitic steels are magnetic at ordinary temperatures after all conditions of heat treatment, have relatively high oxidation resistance at elevated temperatures, and resist attack by many corrosive media. With certain modifications in procedures they can be satisfactorily fabricated by all methods applicable to austenitic grades.

For both pressure and mechanical applications, tubes of straight-chromium stainless analyses are worthy alternates for hard-to-get nickel-bearing stainless types. Would you like a copy of TDC-140 containing technical data on these easy-to-get grades of stainless tubes? Ask Mr. Tubes—your B&W Tube Representative — about their suitability for your applications.

APPLICATIONS

B&W Croloy 12 A1 (Type 405, Seamless) Non-hardening—does not undergo appreciable transformation; therefore no sudden volume change occurs during heating—corrosion and oxidation resistant. Typical uses: Conveyor lines in oil refining and chemical processing, heat exchanger tubing, boiler tubing in mercury heat cycle, catalytic oil cracking processes where fins have been welded to tubes.

B&W Croloy 12 (Type 410, Seamless and Welded) Hardenable—moderate corrosion and heat resistance. Typical uses: Machinery in the chemical and food processing and packaging fields.

B&W Croloy 18 (Type 430, Seamless and Welded) Sufficient ductility for forming simple parts—good corrosion and oxidation resistance—can be polished or buffed to pleasing finish. Typical uses: Conveyor lines in chemical processing field; condensers and piping in production, transportation, and storage of nitric acid and in nitrating operations involving mixed acids; furnace parts; retorts; ornamental structures.

B&W Croloy 27 (Type 446, Seamless) Corrosion resistant—excellent heat resisting qualities. Typical uses: Furnace parts, heat interchangers, kilns, pyrometer protection tubes, soot blower elements, dehydrogenation equipment in chemical and oil refining fields. Also well suited for glass sealing applications.

THE BABCOCK & WILCOX TUBE COMPANY

Executive Offices: Beaver Falls, Pa.

General Offices & Plants

Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

Sales Offices: Beaver Falls, Pa. • Boston 16, Mass. • Chicago 3, Ill. • Cleveland 14, Ohio • Denver 1, Colo. • Detroit 26, Mich. • Houston 2, Texas • Los Angeles 17, Calif. • New York 16, N. Y. • Philadelphia 2, Pa. • St. Louis 1, Mo. San Francisco 3, Calif. • Syracuse 2, N. Y. • Toronto, Ontario • Tulsa 3, Okla.

B&W SEAMLESS and WELDED TUBES

TA-1651B

photogenic CASTINGS

They may have darn little 'cheesecake' appeal but Sivyer Steel Castings take a mighty pretty picture just the same.

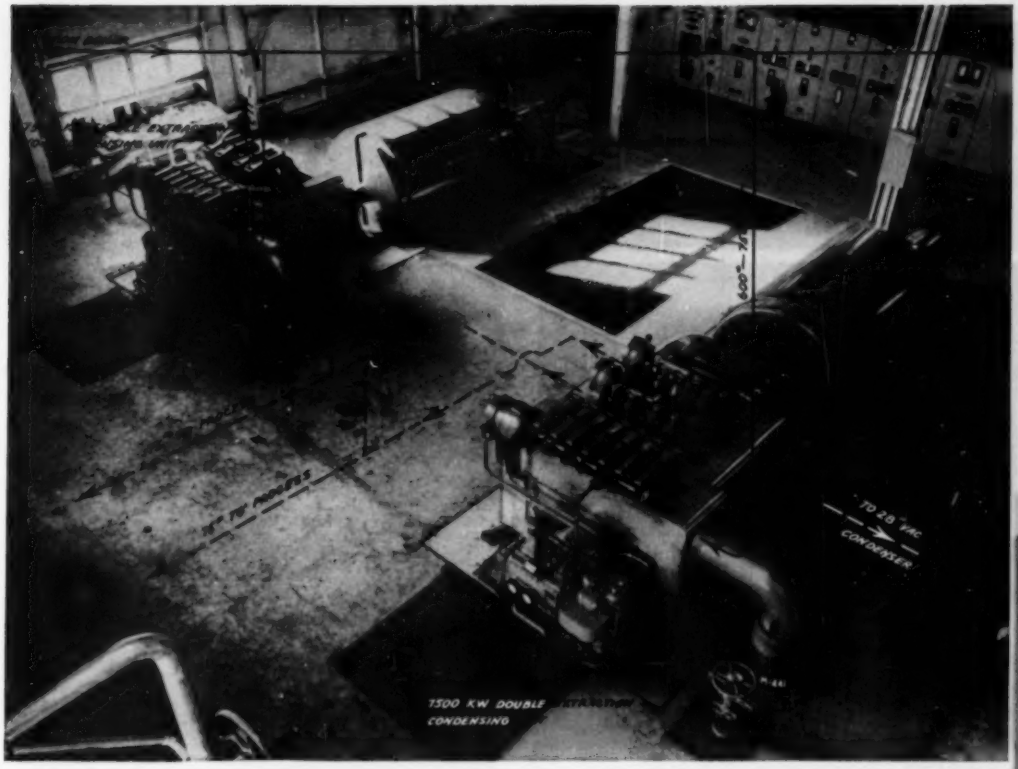
If you've an eye for good finish you'll appreciate the sharp corners, clean core holes, absence of dead metal . . . the dimensional accuracy of Sivyer castings. And that's only part of the story. Sivyer castings sit for a variety of internal portraits too . . . Zyglo, Magnaflux, Gamma rays . . . to detect flaws . . . to guarantee internal integrity of metal which means better, more dependable steel castings for you.

For a better profit picture quit shooting in the dark. Specify Sivyer Steel Castings identified by the famous Sivyer

SIVYER

SPECIALISTS IN HIGH ALLOY AND SPECIFICATION STEEL CASTINGS

SIVYER STEEL CASTING COMPANY • MILWAUKEE CHICAGO



Process Steam Maintained at 2 Pressures

by Worthington Turbine Generators

This is how Worthington and a Far West cellulose mill set up the steam supply for utmost efficiency and flexibility.

We combined a non-condensing single automatic extraction unit with a condensing double automatic extraction unit. The 7500-kw units operate in parallel and, in addition to supplying plant power, furnish steam at two pressures for process requirements.

Along with the advantages of efficient operation and low cost and ability to adjust to mill requirements, this mill benefits from the manufacturer's *unit responsibility*.

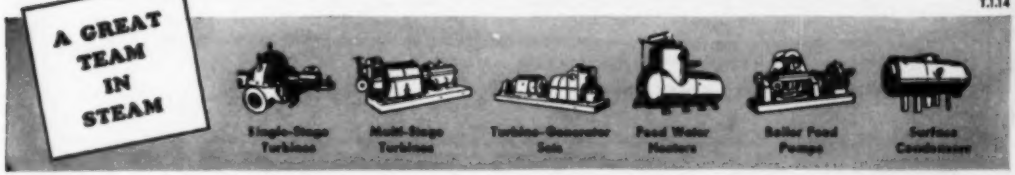
In this case, Worthington also furnished two 470-hp turbines to drive boiler feed pumps, two 452-hp turbines to drive induced-draft fans, two 146-hp turbines to drive forced-draft fans, and one 50-kw turbine-driven exciter set.

If you want proof *there's more worth in Worthington*, write Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, New York.

WORTHINGTON

STEAM TURBINE GENERATORS

T.J.14



Life ...on the

THIS LITTLE PIG WENT TO MARKET, heavier and healthier than ever, because he was fed *Vitamin B_{12} Antibiotic(Aureomycin) Feed Supplement.* Produced by Cyanamid's Lederle Laboratories Division, this new ingredient is now being added to feeds for pigs, chickens and other animals by many leading manufacturers. Tests show that pigs fed such diets gain weight faster and are healthier than those raised on the best of other feeds.

TEST BY TORTURE... new, experimental storm boat hits the beach head-on, at thirty miles per hour, as the Corps of Engineers puts it through performance tests. Ordinary boats would split and splinter beyond repair. This one—because of its amazing impact resistance—came through in one piece. Why? Its hull is molded from Cyanamid's LAMINAC® Resin fortified with "FIBERGLAS".

New Product News

THREE NEW SURFACE ACTIVE AGENTS

	Structure of R Group	Physical Form
Surface Active Agent BO	$C_{12}H_{25}$ 2-Butyloctyl	White, waxy pellets
Surface Active Agent TR	$C_{12}H_{25}$ Mixture of isomers	White, waxy pellets
Surface Active Agent BPE	$C_{12}H_{25}O$ 2-p-tert.-butylphenoxyethyl	White powder

Properties: Entire group of compounds exhibits good emulsifying power in the preparation of stable oil-in-water systems . . . fair detergency in aqueous systems. Agents BO and TR are superior detergents in non-polar solvents and are outstanding for dispersing solids in hydrocarbon systems. BPE is excellent for dispersing in aqueous systems.

Possible Uses: Textiles, paper, cosmetics.

Chemical Newsfront

SITTING PRETTY? What young lady wouldn't be in an attractive cotton dress treated to resist wrinkling and soiling! Cyanamid's SUPERSET® Resin finish imparts these qualities to women's cotton garments, men's sports shirts and other apparel . . . makes them easier to wash and iron, eliminates the need for starching.

NEW CYANAMID PLANT at Michigan City, Indiana, boosts production of AEROCAT® Synthetic Fluid Cracking Catalysts. Put into operation this past summer by Cyanamid's engineers, this unit substantially increases Cyanamid's catalyst output, helps petroleum refiners meet the ever-growing demand for high octane fuels. Unique feature of the new installation: a spray-drier believed to be the largest of its kind in the world—used to form the catalyst into microspheroidal particles.

The new plant will supply refining areas throughout the Midwest, along the Atlantic seaboard and in Canada—supplementing Cyanamid's Fort Worth, Texas, plant which serves the Southwest and Far West.

American Cyanamid Company CE. 12-51
30 Rockefeller Plaza, New York 20, N. Y.

Please send literature or further data on the items checked:

- ☐ SUPERSET Resin Finish
- ☐ LAMINAC Resin
- ☐ AEROCAT Cracking Catalysts
- ☐ Vitamin B_{12}—Antibiotic (Aureomycin) Feed Supplement
- ☐ Surface Active Agents

Name.....

Company..... Position.....

Address.....

City..... State.....

In Canada: North American Cyanamid Limited, Toronto and Montreal

AMERICAN Cyanamid COMPANY

30 ROCKEFELLER PLAZA · NEW YORK 20, N. Y.

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WALSEAL*

FOR MAKING SILBRAZ* JOINTS

Cutaway view of a Walseal Tee showing: 1—factory-inserted ring of silver brazing alloy; 2—fillet of silver brazing alloy that appears upon completion of Silbraz joint; 3—cutaway view of the completed Silbraz joint showing that silver brazing alloy has flowed in both directions from the factory inserted ring.

When you see this fillet of alloy, and the fitting is Walseal you know that you have penetration because the alloy comes from the inside.

When you make Silbraz* joints in your brass, copper, or copper-nickel pipe lines with Walseal Valves, Fittings, or Flanges you know you have the right amount of the correct type of silver brazing alloy. The ring of Sil-Fos brazing alloy is factory-inserted in the ports of Walseal products at the time of manufacture.

No lost time or motion in handling the alloy . . . no difficulty in getting full penetration of the alloy regardless of the position of the valve or fitting . . . no guessing whether the joint is made right . . . the fillet of alloy that shows up when the Silbraz joint is completed, comes from the inside!! And, whether you've made the Silbraz joint yourself, or inspecting the work of another, you know that if the silver alloy fillet is visible, and the valve or fitting is Walseal, you have full penetration. That's why nobody guesses when you use Walseal!

Walseal products are backed by the reputation of the Walworth Company, manufacturers of valves and pipe fittings since 1842.

For full information regarding Silbraz joints made with Walseal products, write for Circular 84.

*Patented—Reg. U. S. Pat. Off.

Recommended for

- Hot and Cold Water Circulating Systems
- Boiler Feed Lines
- Steam Return Lines
- Condensate Lines
- Low and High Pressure Air Systems
- Lubricating Oil Circulating Systems
- Industrial Gas Piping
- Solvent and Vacuum Piping Systems

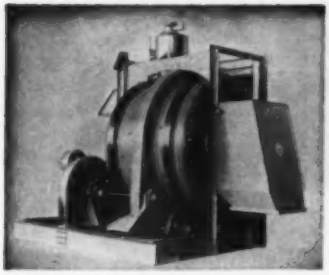
Make it "a one-piece pipe line" with WALSEAL

WALWORTH

valves and fittings

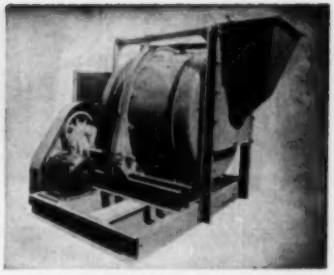
60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

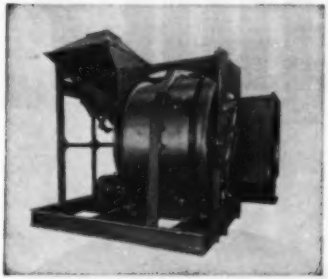


CHEMICALS—Equipped with liquid measuring tank for use in various chemical applications.

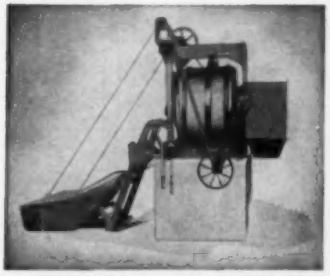
CHEMICALS • DRUGS • PLASTICS METALS • FOOD • CANDY—Pan is tilted and rotated by motors. Capacities up to 3090 lb.



COMPOSITION MATERIALS • INSULATING AND REFRACTORY CHEMICALS • CLAY • GLASS BATCHES • FOUNDRY CORE SAND—13 cu ft dry mixer on skids.



ENAMEL FRITS • GLASS—50 cu ft dustproof mixer. Fully-automatic, electrically controlled charging and discharging.



FURNACE CHARGES • GLASS BATCHES—28 cu ft mixer with elevating power loader.

How To Straighten Out Your Mixer Problems

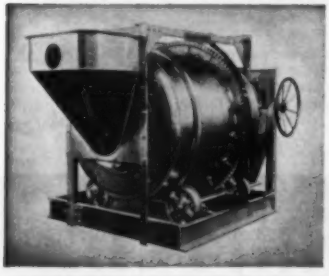
What do you mix? Here's a partial line-up of industrial mixers bearing the famous Worthington-Ransome trademark—which means the right design for every type of mix.

And you'll find in every mixer the following Worthington-Ransome features: *thorough* mixing (or blending) of even the finest dry materials or colors in any proportion . . . *clean* discharge . . . *dustproof* design (where required) . . . *heavy-duty* construction.

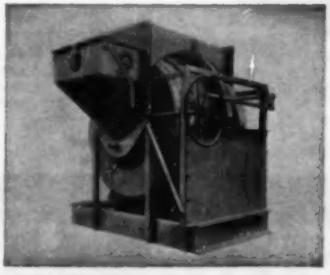
For solution of your particular mixing problem or for free bulletins, write: Worthington Pump and Machinery Corporation, Ransome Industrial Mixer Division, Dunellen, New Jersey.

WORTHINGTON

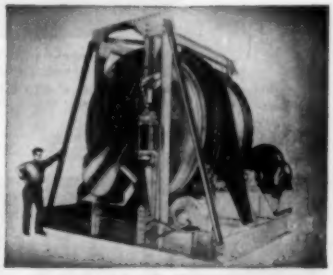
YR.1.1



SOAP POWDER • PIPE TOBACCO • SNUFF—Dustproof mixer for blending and mixing.

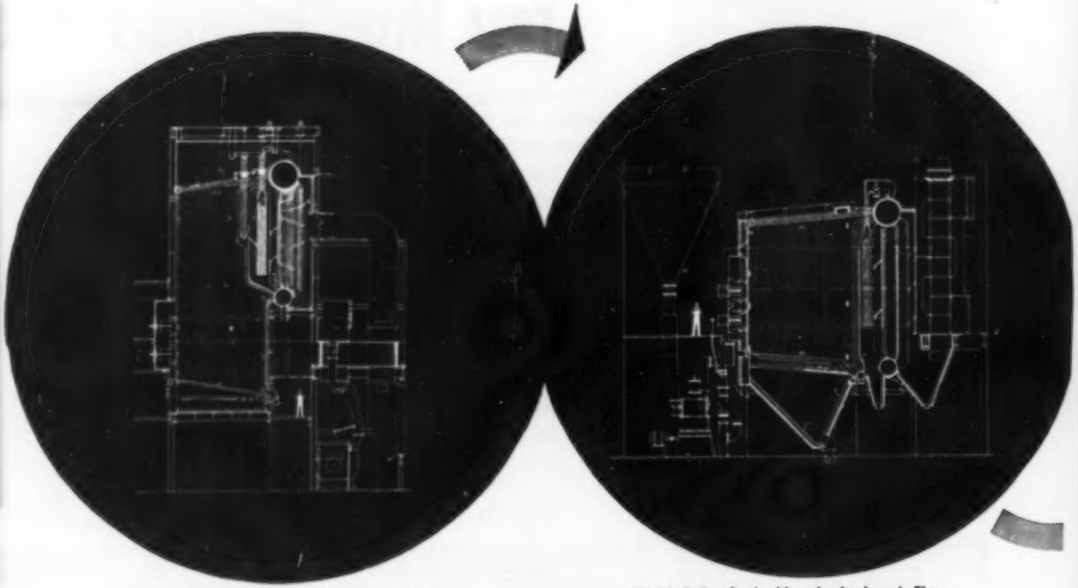


FERTILIZER—Standard sizes, ½, 1, 2-ton capacity. Also used for asbestos products, etc.



FURNACE CHARGES—One of the largest industrial mixers—batch capacity of 260 cu ft.

Are VU Boilers habit forming?



VU-50 Boiler fired with oil. The capacity of the unit shown is 350,000 lb of steam per hour; operating pressure—920 psi; total steam temperature—905 F.

VU-50 Boiler fired with pulverized coal. The capacity of the unit shown is 150,000 lb of steam per hour; operating pressure—625 psi; total steam temperature—760 F.

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

The record shows that they are. More than 100 companies . . . large and small . . . throughout this country and abroad . . . have ordered VU units more than once. Nearly half of these have ordered more than twice. Some as many as 5 or 6 times.

Considered in light of the fact that Vertical-Unit Boilers have never been — nor are likely to be — the cheapest you can buy, such a record becomes even more significant.

Here are just a few examples of the many industries that appear to have formed the VU habit.

A Steel Company now has a total of eleven VU Units in three different plants. Starting with an initial installation of three units in 1940, it has reordered twice; three units for a second plant in 1946 and five units for a third plant in 1950.

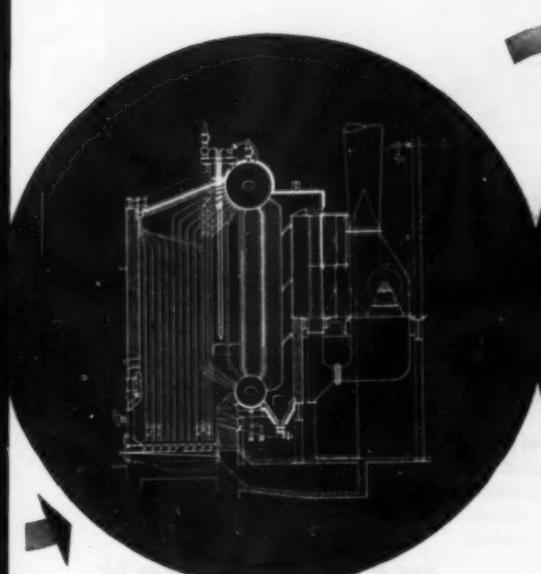
An Electric Utility Company started using the VU in 1944 when two units were installed at one of their power stations. When the capacity of this station was increased in 1948 two more units were installed. In 1947 this company ordered two more units for another of its stations.

An Oil Company ordered its first VU in 1937, its second in 1938. In 1942 another VU was installed and still another in 1944.

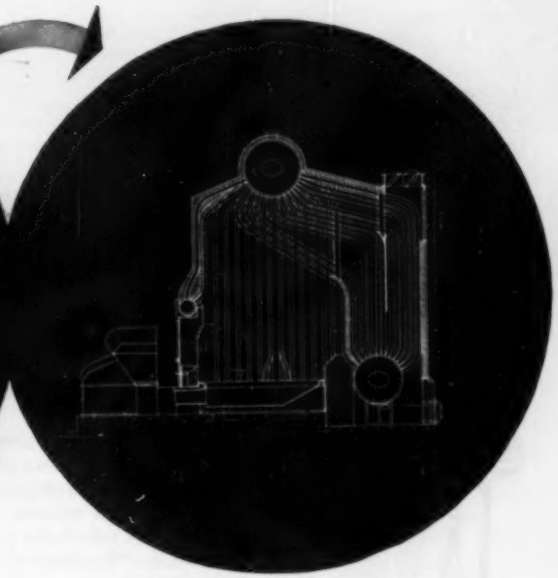
An Aluminum Company is another consistent buyer of VU Units. Since installing its first VU in 1940, it has reordered four times, and now has five C-E Vertical-Unit Boilers in service.

* * *

Just a small sample to be sure, but one that can be repeated over and over for other industries and other companies . . . companies that have ordered and reordered VU Boilers . . . companies that have the "VU habit" and find it highly profitable. B-511



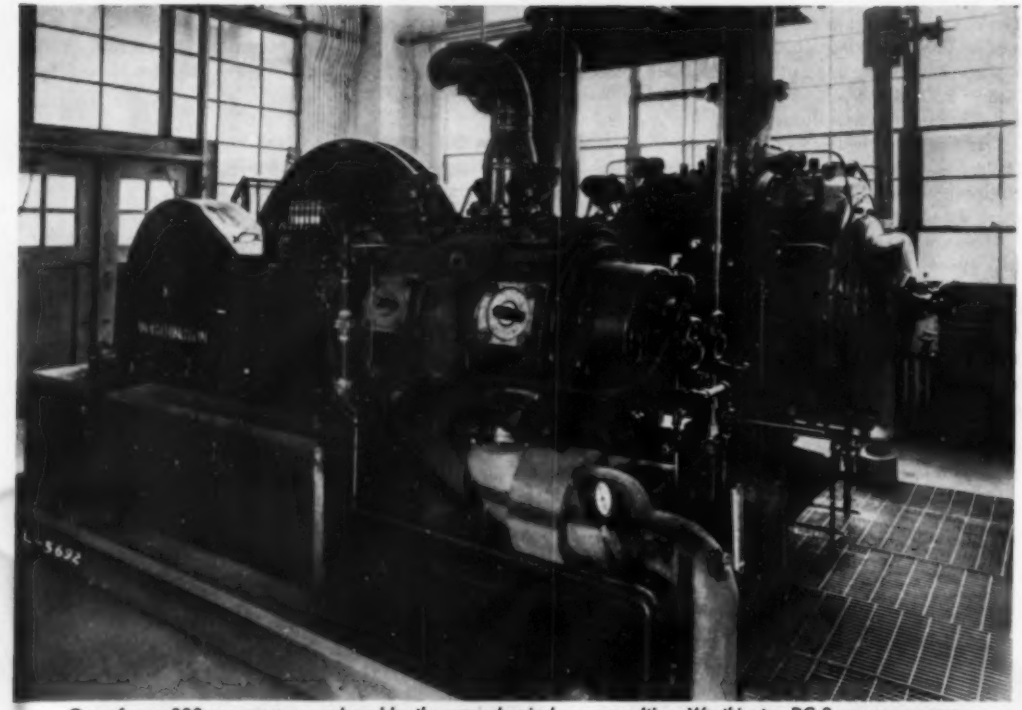
VU-50 Boiler as adapted for firing bagasse on a C-E Spreader Stoker. The capacity of the unit shown is 75,000 lb of steam per hour; operating pressure—160 psi; total temperature—530 F.



VU-10 Boiler fired with C-E Skelly Stoker. VU-10 Boilers range in capacity from 10,000 to 60,000 lb of steam per hour. They may be fired by underfeed, spreader or chain grate stokers or by oil or gas.

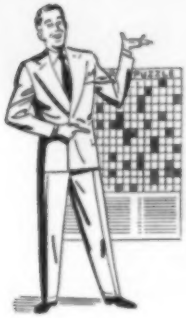
— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.

C·E



One of over 300 compressors purchased by the same chemical company. It's a Worthington DC-2 gas compressor.

What One Word—Here—Solved Over 300 Compressor Problems?



Over 300 times in the past ten years, a mid-western chemical company has had a compressor problem.

Sometimes the problem involved a small compressor, sometimes a giant. All types of drives. All types of applications—including pulling a vacuum. Almost invariably, they solved the problem with one word—"Worthington".

To help solve *your* compressor problems, Worthington offers *more* compressors for compressing *more* gases than any other manufacturer.

Remember, too, that Worthington compressors are the only ones with Feather* Valves—the simplest, lightest, highest quality valves made.

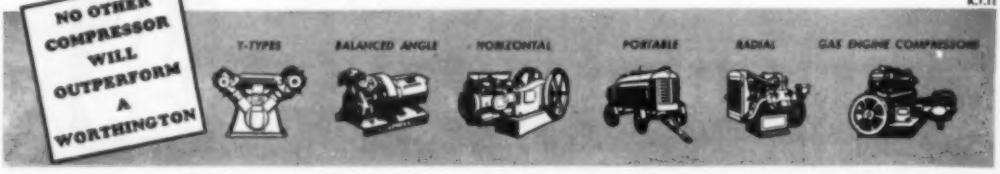
Write for Bulletin . . . to Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.

WORTHINGTON

COMPRESSORS

*Reg. U. S. Pat. Off.

K.1.11



IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS

...where flow efficiency is a vital factor

You can depend on Ladish Controlled Quality Fittings to maintain maximum flow characteristics of any piping system . . . and do it consistently year after year. For advanced Ladish engineering assures the true circularity, full effective radii and smooth inner surfaces necessary to keep turbulence and friction loss at a minimum . . . features which are doubly safeguarded by the high, inflexible standards of Ladish Controlled Quality.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
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District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
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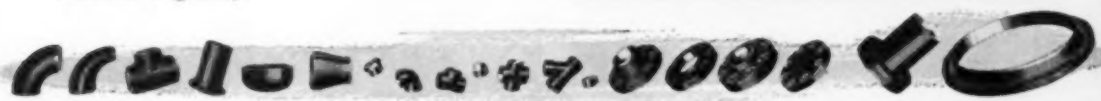
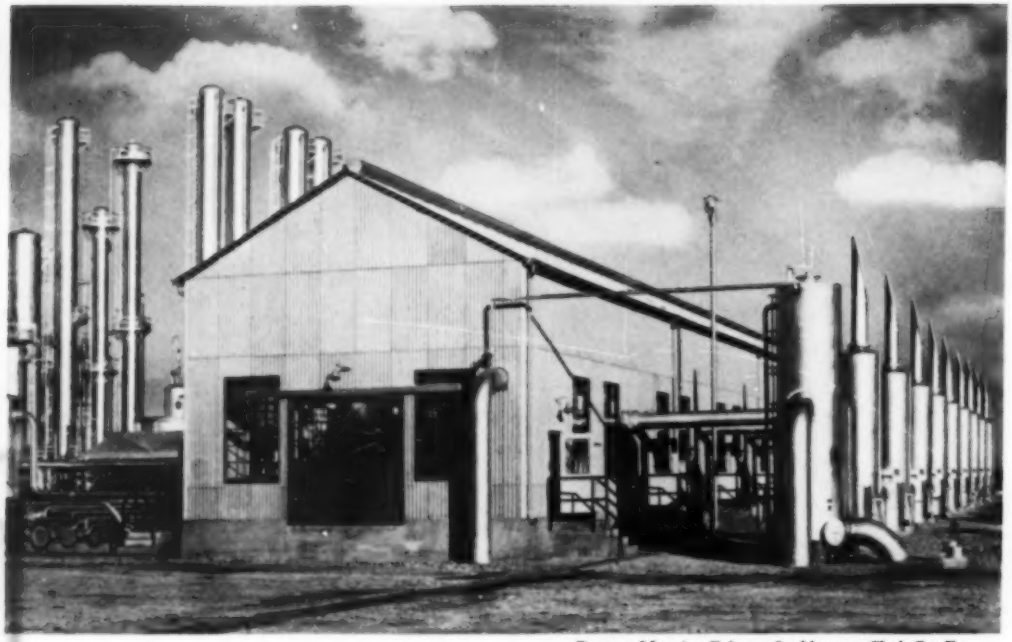




Burgess-Manning Exhaust Snubbers on Clark Gas Engine compressors at a New Mexico compressor station.

Compressor Stations Select Burgess-Manning Snubbers

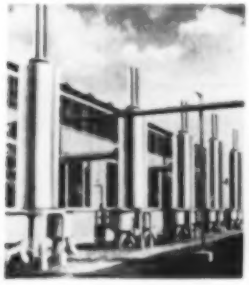
for Quiet Operation

● Selection of Burgess-Manning Snubbers by the management of these typical compressor stations is indicative of the wide acceptance by the petroleum industry of Burgess-Manning as the leading authority on effectively reducing noise from engine exhausts and compressor intakes. Almost a quarter century's extensive research and field experience enables Burgess-Manning to handle your engine and compressor noise control problems with the confidence of achieving a successful solution. See Burgess-Manning engineers, today.

BURGESS-MANNING COMPANY LIBERTYVILLE, ILLINOIS

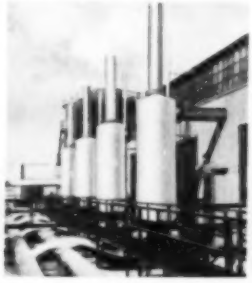
1203 Dragon Street, Dallas, Texas

Kansas pipe line compressing plant with Burgess-Manning Snubbers installed.



Exhaust Snubbers on engine compressors at a New Mexico gasoline plant.

Texas gas pipe line station with Burgess-Manning Snubbers installed.



Missouri compressor station equipped with numerous Burgess-Manning Snubbers.

Our Defense Program Faces a Crisis

A major crisis will soon confront our defense program.

It is not a crisis in raw materials. To find enough materials, from steel to cobalt, for defense production is a serious problem. But it is one that is being solved.

It is not a crisis in manpower. Shortages of workers with special skills hamper production, but these shortages are being relieved, slowly.

It is not a crisis in manufacturing capacity. American industry's record-breaking expansion is, with very few exceptions, keeping abreast of defense needs.

The coming crisis will be one of finance. It will rise from our failure to provide the means to PAY FOR the defense program we now have under way.

A $15 Billion Deficit?

Congress has approved a defense program which is scheduled to raise *total* federal spending in the year from June, 1952, to June, 1953, to somewhere between $85 and $90 billion. Additional appropriations for more air power and atomic development, which are now proposed, would add several billion dollars.

But Congress has not approved a tax plan to match such spending. With the new levies enacted in this session, tax collections during the 1952-53 fiscal year are estimated to fall somewhere between $70 and $75 billion. That would be roughly $15 billion short of balancing the budget. If the defense program is expanded, the deficit will be that much greater.

We have not yet felt the impact of the crisis that would accompany a federal deficit of this magnitude. Federal tax collections currently are big enough to balance federal expenditures. But the defense program is scheduled to boost the annual rate of federal expenditures $25 billion in the next year.

To Meet the Crisis

By January the crisis will be clearly in sight.

Then the President will present his budget. After that, Congress must act to close the broad gap between government income and government spending. If it fails to do that, the whole defense program will be menaced by weakness in its financial foundations. That weakness might well take the form of another destructive wave of inflation.

We have three ways to meet this crisis.

The best approach, of course, is to cut unessential expenditures. That can make a real dent in the deficit. The second is to collect more

taxes. The third, and by all odds the most dangerous, is to have the federal government meet its deficit by going deeper into debt. Borrowing, which might feed inflation, can easily lead to disaster.

Near Income Tax Limits

It will not be possible to raise taxes to meet the deficit merely by increasing further the rates on corporations and on persons in the upper income brackets. Congress has about scraped the bottom of that barrel.

The Senate Finance Committee said as much in reporting this year's tax bill. The Committee reported that it had "serious doubts as to the feasibility of raising any substantial additional amounts of revenue from income tax sources." The Committee observed that recent tax legislation brings the burdens of most corporate and individual income taxpayers close to the World War II peaks, and actually carries the rates paid by many taxpayers above those peaks.

Our ramshackle federal tax system must be thoroughly overhauled in order to broaden the tax base if it is to produce more revenue—without doing much more harm than good.

The shocking fact is that no one seems ready to act along any line that might enable us to surmount the crisis.

That fact of itself aggravates the coming crisis. And next year's presidential election doesn't make it any easier to move effectively. Both parties will shrink even more than normally from backing any program that might irritate any considerable number of voters.

If we are to meet this crisis on the tax front in an orderly way, the technical work should be in progress right now. To a large extent it is being ignored.

If we are to enforce the vitally essential program of government economy, there is the same urgent need to get under way the spade work that is required.

And if—as a last miserable expedient—we decide to let the federal government drift deeper into debt, it must have a well-developed program of borrowing from individuals and other investors, such as insurance companies, rather than from the commercial banks. Borrowing from commercial banks might speedily translate the deficit into more and more price inflation. No adequate program of borrowing from savings is now in sight.

Now Is the Time

It is possible, of course, that international relations may improve sufficiently to make it safe for us to slow down the rearmament program. If that should happen, the fiscal crisis would not be so critical. But that kind of good fortune has been notably absent in recent years.

Lenin, patron saint of Communism, is quoted to the effect that to destroy a political and social system such as ours "you must debauch its money."

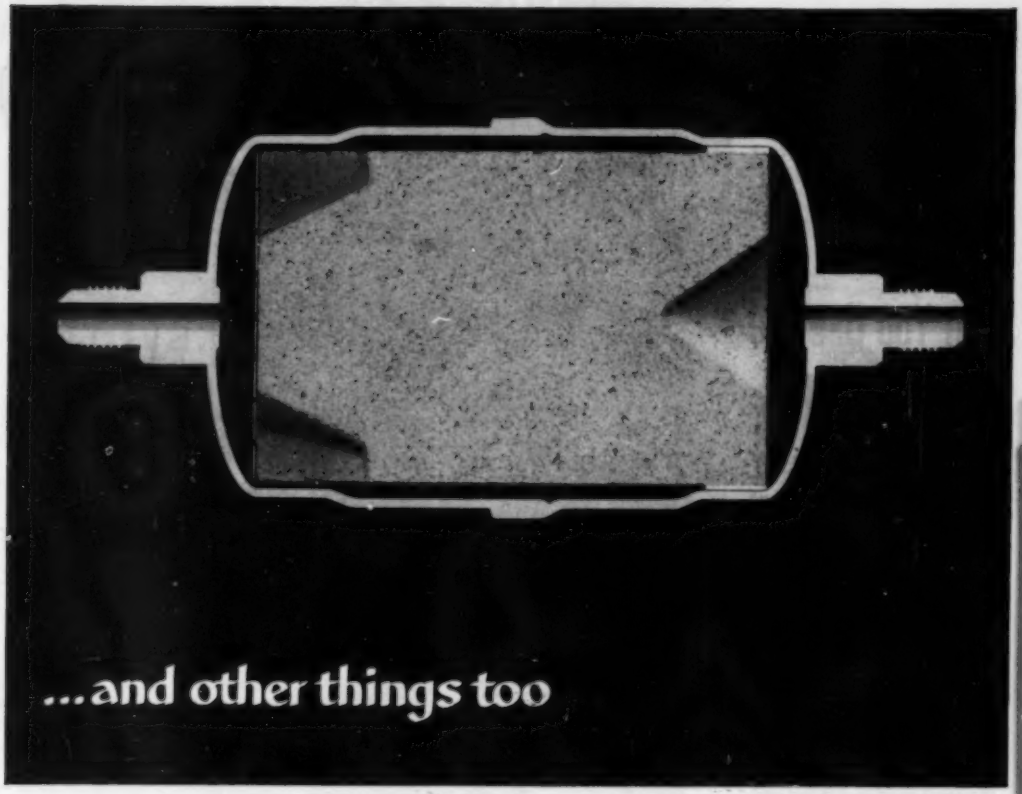
We shall set democracy to digging its own grave if, through our preoccupation with politics during the presidential campaign, we pave the way for further debauchery of our money.

If we really want to avert that disaster, now is the time for us to get going.

Once the crisis is full upon us, it will be too late.

McGraw-Hill Publishing Company, Inc.

The inside story on drying refrigerants



Continually maintaining a *dry* refrigerant is essential to the operation of any refrigeration system. But *how much* moisture is removed is far less important than *how little* is left—even a drop of water can cause expensive breakdowns. An exceptionally efficient drying agent—such as ALCOA *Activated* Alumina—is required for such an exacting job.

That's why Sporlan Valve Company, St. Louis, Mo., put ALCOA *Activated* Alumina inside their Catch-All Filter-Drier, illustrated above. Molded of granulated alumina, the unique porous core dries refrigerants to an end point so low that any remaining moisture is harmless. Moreover, it cannot channel or powder because ALCOA *Activated* Alumina is a thoroughly reliable, non-corrosive drying agent that will not change its form or properties—will not swell, soften or disintegrate.

Helping to keep refrigerators cold is only one of many jobs ALCOA *Activated* Alumina is doing successfully. Its desiccating properties are finding widespread application in the chemical, food, pharmaceutical and petroleum industries, in air conditioning, and for the maintenance of transformer and lubricating oils.

You should be taking advantage of the economies offered by ALCOA *Activated* Alumina. We'll gladly send you additional information. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 602M Gulf Building, Pittsburgh 19, Pa.

Alcoa Chemicals

ALCOA

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDES • SODIUM ACID FLUORIDE • FLUORBORIC ACID • CRYOLITE • GALLIUM

Can You Use the "UTILISCOPE"?

The advertisement at the right appeared in BUSINESS WEEK. It has been suggested that this ad contains considerable food for thought for the readers of CHEMICAL ENGINEERING. The steel making application illustrated here may not interest you but it probably will suggest other uses for the "Utiliscope" in your operations.

If you want to look into the possibilities of the "Utiliscope", simply write us for a copy of Bulletin 1025C which explains the equipment and shows various applications. Please address your request to Department "C".

Diamond Power Specialty Corp.
Department "C"
Lancaster, Ohio

NOW You Can *See* Where You Can't *Look*

Eliminating Hazards and Reducing Costs

IN STEEL MAKING with the

DIAMOND "UTILISCOPE"

(WIRED TELEVISION)

Continuous casting of billets is a process which promises very important reduction of steel making costs. Formerly, a man had to stand close to the stream of molten steel watching the surface of the metal in the mold and always ready to signal the operator 50 feet away. The hazard was great and discomfort from radiant heat quickly became unbearable.

Now, a "Utiliscope" (wired television) camera with a long focal length lens is placed above the metal surface. The viewer is placed at the control panel. The operator can see everything that happens at close range in comfort and safety . . . can watch more effectively than a man close to the molten steel.

This is one of the many applications where the Diamond "Utiliscope" promotes safety . . . improves operation . . . saves labor. The "Utiliscope" extends the power of the eye so you can see around corners, through walls, into fire and through water. It is simple and easy to use. Installation requires no special skill. Adjustment of focus, brilliance and contrast is quickly and easily made.

You may have a place where the "Utiliscope" will save you money, or solve a difficult problem. Write for Bulletin 1025 with complete description; it suggests many possible uses.

OTHER USES

- Studying destructive tests of engines
- Checking remote gage readings
- Observing conditions inside furnaces
- Viewing nuclear research
- Coordinating material flow on conveyors

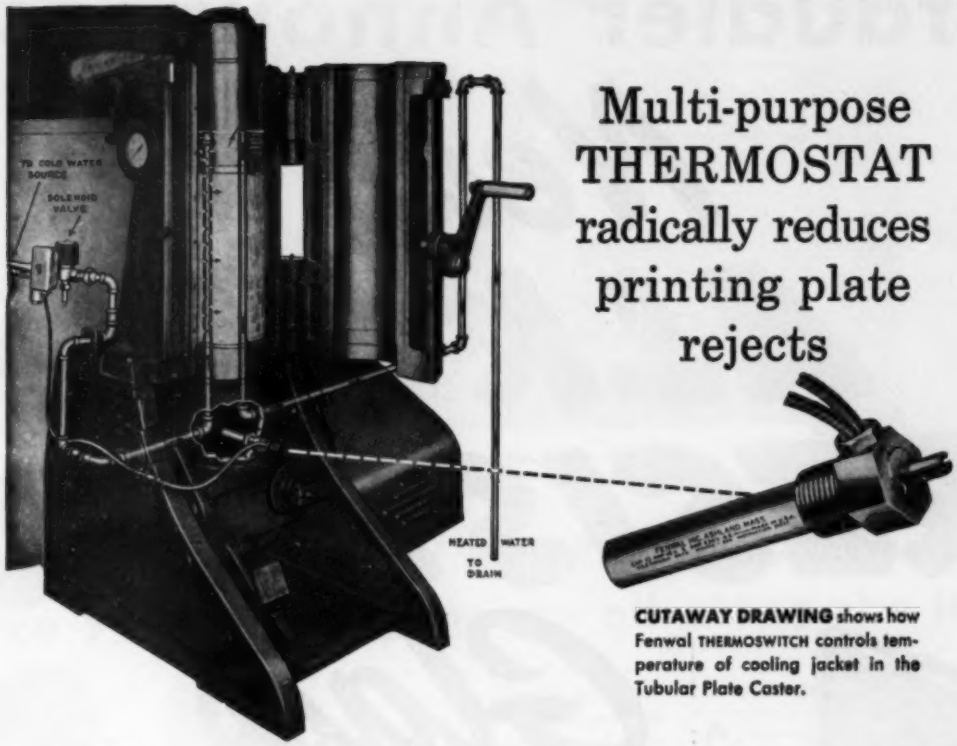
The "Utiliscope" (Reg. U. S. Patent Office)

WRITE FOR BULLETIN 1025C

DIAMOND POWER SPECIALTY CORP.
First in Industrial Television
LANCASTER, OHIO
DIAMOND SPECIALTY LIMITED
Windsor, Ontario

Since 1903, Diamond has Manufactured Quality Equipment for Industry

Multi-purpose THERMOSTAT radically reduces printing plate rejects



CUTAWAY DRAWING shows how Fenwal THERMOSWITCH controls temperature of cooling jacket in the Tubular Plate Caster.

The Tubular Plate Caster machine used in the production of printing plates at the Nordmann Printing Company, 4210 Chippewa St., St. Louis was the seat of considerable trouble when it was water cooled by a hand valve. If too much cold water was run into the cooling jacket, the temperature was reduced so fast that the plates shrank. If too little water entered, the temperature remained too hot and plates became porous. In either case, plates had to be remelted and recast with resultant loss of labor and time.

The problem was solved by replacing the hand valve with a solenoid water valve and installing a low-cost Fenwal THERMOSWITCH thermostat. This unit opens the valve when water gets too hot. Cold water then flows in, hot water drains off, and valve is shut when proper water temperature is reached. *As a result, rejects have been practically eliminated.*

This is but one of many ways in which easy-to-install, easy-to-maintain Fenwal THERMOSWITCH Units effectively control variables where heat is a factor. Their unique principle of operation consists of an activating control element that is a single-metal shell. This shell expands or contracts *instantaneously* with temperature changes, making or breaking the totally enclosed electrical contacts.

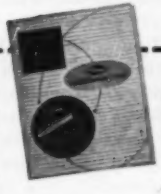
Fenwal THERMOSWITCH thermostats can no doubt help you in your own processing. Find out how by mailing the coupon today.

Fenwal

THERMOSWITCH

The Precision Multi-Purpose Thermostat Control

SENSITIVE . . . but only to heat



FREE! **Get this bulletin . . . see what Fenwal THERMOSWITCH units can do for you. *Just fill in coupon and mail . . . no obligation.***

FENWAL, INCORPORATED, 166 Pleasant St., Ashland, Mass.
Los Angeles, Cal.
TEMPERATURE CONTROL ENGINEERS

Name ..... Position .....
Company .....
Street .....
City ..... Zone ..... State .....

I am chiefly interested in the applications checked:

- ☐ Heating
- ☐ Cooling
- ☐ Humidity Control or Detection
- ☐ Alarm (over-temperature, under-temperature)
- ☐ Vapor Control
- ☐ Timing (thermal)
- ☐ Radiant Heat Control
- ☐ Pressure Control (by controlling vapor temperature)

OTHER (Please fill in your special requirements) .....
.....
.....

Pfaudler Announces

New ALKALI-RESISTING Glass

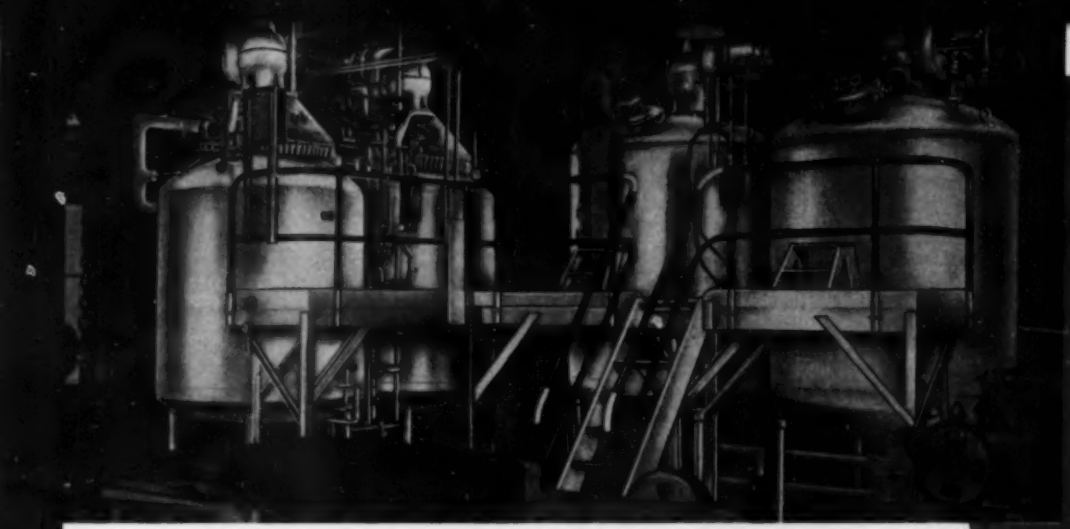
Broadens usefulness, boosts economy of glass-lined chemical process equipment

DO YOU have a problem handling alkaline solutions in the pH range from 9 to 12? If your processes do not require concentrated alkalies or temperatures above 212° F., the chances are that this new Pfaudler glass can solve your problem.

Always alert to the growing needs of the Chemical Industry, Pfaudler has developed—at the request of many processors—a new glass for lining chemical processing equipment that is not only acid-resisting, but now more *alkali-resisting* than ever before.

Here is another outstanding achievement that proves Pfaudler's leadership in the field. It is part of a broad Pfaudler program for increasing the usefulness, the flexibility and the economy of chemical processing equipment . . . through research, product development and technical service that is always keyed to the rapidly expanding pace of the Chemical Industry. For example, 10 years ago the largest standard glass-lined vessel offered to the industry was 1000 gallons in size with pressures limited to 50 lbs. Today, Pfaudler is regularly supplying 3500 gal. reactors permitting pressures up to 125 lbs. Pfaudler has also developed a number of accessories such as improved gasketing, high pressure stuffing boxes, variable speed drives with rotor seals, high pressure flanges and complete glass-lined pipe and valve assemblies.

And for the future, Pfaudler will continue to increase the usefulness of its products through research and developments based on the needs of the industry. The Pfaudler Co., Rochester 3, N. Y.



USERS, who have tested this new glass, find that it is *at least three times more resistant* to alkaline solutions than any Pfaudler glass formerly available.

How new Pfaudler *ALKALI-RESISTING* Glass can *save you time and money* all along the line

COMPARATIVE TESTS show that new Pfaudler alkali-acid-resisting glass (left) withstands buffered NaOH,pH 11.5 at 212° F. for 30 days with no noticeable change, while former high-quality Pfaudler glass (right) is severely etched under the same conditions.

WHY the chemical process industries prefer glass-lined equipment:

1. Pfaudler glass, backed by steel, is *one of the most durable materials of construction.*
2. Resistance to all acids (except hydrofluoric)—now combined with resistance to alkaline action for even greater flexibility and service life.
3. Product purity is improved by elimination of metallic contamination.
4. Ease of cleaning and sterilizing protects product quality, saves time and labor costs.
5. Polymers will not adhere to glass surface.

Pfaudler glass backed by steel—*one of the most durable materials of construction* known to man—is now better, more flexible, and more economical to use than ever before!

ACID-RESISTING, TOO!

The new Pfaudler glass was specially developed to give *longer life* to glass-lined equipment where alkaline reactions are encountered, but *without any reduction whatsoever in its acid-resisting properties.* It promises to solve many chemical processing problems in the pH range from 9 to 12, which, until now, have been unusually severe on glass-lined equipment.

ADDED FLEXIBILITY!

Now, for the first time, the new Pfaudler glass makes it possible for you to go from acid to alkaline solutions in the same vessel. And the easy-cleaning features of Pfaudler glass-lined equipment allow you to make the change in minimum time.

HOW YOU SAVE...

This new flexibility means that you need only one vessel where dissimilar operations formerly required two. What's more, you can standardize on a single type of unit and narrow down on spare parts. You'll need fewer structures and be able to save space, too. And use of the new glass may even eliminate many of your valve, piping, pumping and gasketing problems.

MANY APPLICATIONS!

Many uses are indicated for vessels lined with the new Pfaudler Alkali-Resisting glass. For example, neutralization of acid solutions in the same processing unit; storage of mild alkalies; processing of alkaline reactions within the range of pH 12 and up to 212° F. Are there other uses in *your* processing?

GET ALL THE FACTS! Send the coupon today for full details on this amazing alkali-resisting, acid-resisting glass.

Pfaudler

THE PFAUDLER CO., ROCHESTER 3, N. Y.

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

THE PFAUDLER CO., DEPT. CE-12, ROCHESTER 3, N. Y.

Send complete information on the new Pfaudler Alkali-Resisting Glass to:

Name _____

Title _____

Company _____

Address _____

City _____ **Zone** _____ **State** _____

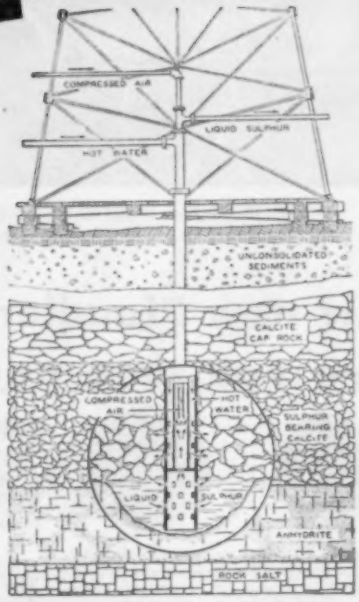
SULPHUR

*Interesting Facts Concerning This Basic Raw Material from the Gulf Coast Region

*WELL PIPING

The well equipment consists of pipes of various sizes, placed one within the other and extending from the surface into the sulphur deposit. A 10" or an 8" casing extends to and rests on the top of the cap rock. A 6" pipe, inside the casing, passes below it and reaches into the barren anhydrite. It is perforated at two different levels, separated by an annular collar. The upper set of perforations permits the hot water to enter the sulphur formation and the lower set permits the entrance of the molten sulphur to the discharge pipe fitted inside the 6" pipe.

When a well is "steamed" the hot water passes down the annular space inside the 6" pipe and outside the sulphur pipe and flows through the upper set of perforations into the porous formation. The entire mass through which the hot water circulates is raised to a temperature above the melting point of sulphur. The liquid sulphur being heavier than water, makes its way downward to form a pool and displaces water around the foot of the well, and rises in the well column through the lower perforations into a 3" pipe which is the sulphur discharge pipe. Compressed air released at the bottom of still another pipe fitted inside the 3" pipe rises and mixes with the sulphur column, forming an air lift which raises the liquid sulphur free of water to the surface.

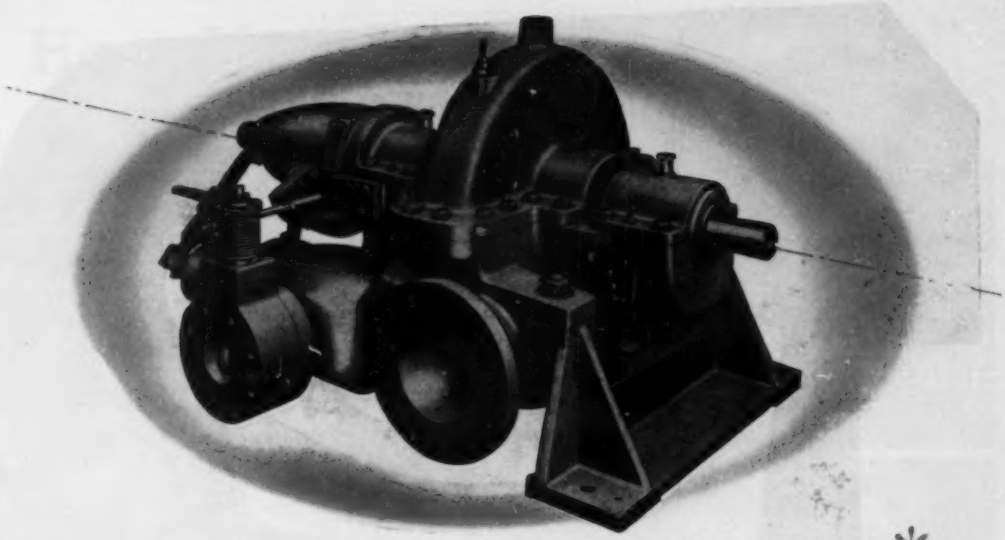


Loading operations at our Newgulf, Texas' mine

TEXAS GULF SULPHUR CO.
INC.

75 East 45th St. New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas



Alignment that *STAYS TRUE** when the heat's on!

Three-Way Centerline Support

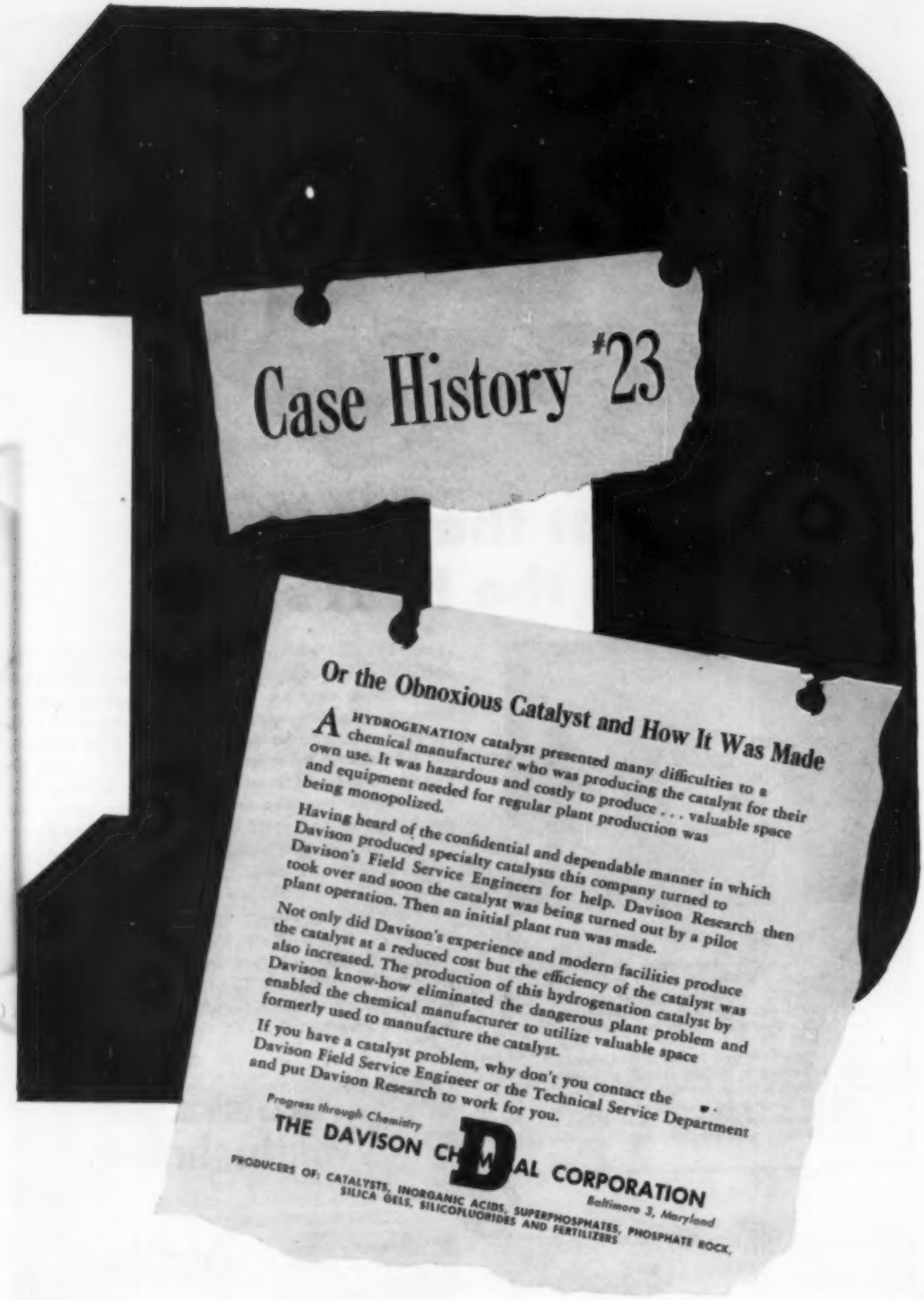
* The Type E method of support allows three-way freedom of expansion and contraction without disturbing the alignment of the rotor shaft. The governor end is mounted on a strong but flexible channel beam to permit axial expansion. At the shaft-coupling end, a unique keyed support connects to the turbine near the shaft centerline to permit lateral expansion; and a vertical kingpin transmits thrust from the expanding steam pipes directly to the foundation and not to the turbine. The casing is free to move vertically with expansion or contraction.

Heat expansion can't disturb Type E alignment. The operation of driven equipment is easier, more dependable —installation costs are reduced. Westinghouse unique *three-way centerline support* keeps alignment perfect with the driven machine. Strong supports at both the governor and exhaust ends are supplemented by a vertical kingpin that transmits lateral thrust to the foundation. Hot or cold —for constant operation or instant stand-by power, you can depend on the Type E Turbine to "Stay True"!

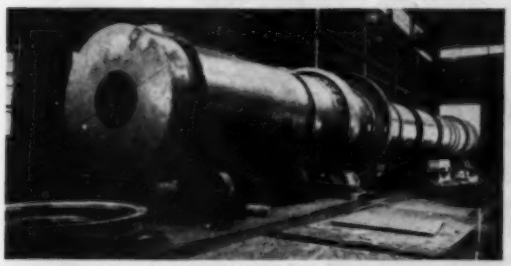
There are other cost saving advantages, too. Dual protection against overspeed, weatherproof bearing seals, corrosion-resisting gland zones, floating movement of governing and trip linkage, and parts interchangeability between wheel sizes are just a few.

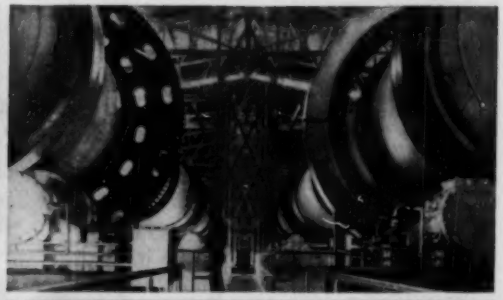
For the full story ask your nearby Westinghouse Steam Specialist for the Type E Turbine Book B-3896, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50520

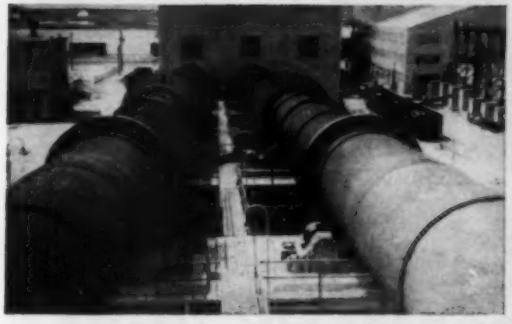
YOU CAN BE SURE... IF IT'S
Westinghouse
TYPE E Turbines


Case History #23
Or the Obnoxious Catalyst and How It Was Made
A HYDROGENATION catalyst presented many difficulties to a chemical manufacturer who was producing the catalyst for their own use. It was hazardous and costly to produce . . . valuable space and equipment needed for regular plant production was being monopolized.
Having heard of the confidential and dependable manner in which Davison produced specialty catalysts this company turned to Davison's Field Service Engineers for help. Davison Research then took over and soon the catalyst was being turned out by a pilot plant operation. Then an initial plant run was made.
Not only did Davison's experience and modern facilities produce the catalyst at a reduced cost but the efficiency of the catalyst was also increased. The production of this hydrogenation catalyst by Davison know-how eliminated the dangerous plant problem and enabled the chemical manufacturer to utilize valuable space formerly used to manufacture the catalyst.
If you have a catalyst problem, why don't you contact the Davison Field Service Engineer or the Technical Service Department and put Davison Research to work for you.
Progress through Chemistry
THE DAVISON CHEMICAL CORPORATION
Baltimore 3, Maryland
PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

Have Your Kiln "Traylor-Made" To Cut Thermo-Processing Costs





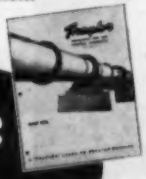


Traylor's individual engineering pays off in greater operating economy . . . better product quality.

In building literally miles of Rotary Kilns, Traylor has seldom built two exactly alike, except for the same customer on the same process. Each one has been "Traylor-made" especially for its particular job.

Diameter; length; type of supports; method of firing; all have a direct bearing on the operating efficiency and quality of product produced by a Rotary Kiln. That's why Traylor engineers make a careful study and detailed analysis of each individual installation before a kiln is "Traylor-made" for the job. Consult with Traylor engineers to benefit by this method of solving calcining problems. There's no obligation.

Rotary Coolers, Dryers and Slakers are also in Traylor's line of process equipment. Traylor Rotary Coolers are built in 3 types; Dryers in 2 types. Traylor Slakers, like the coolers and dryers, employ many of the same construction features that have made Traylor Rotary Kilns the choice of leading Chemical Processors throughout the world. Mail coupon for bulletin 6121.



Traylor

Jaw, Reduction and Gyratory Crushers
Grinding Mills . Crushing Rolls
Rotary Kilns, Coolers and Dryers

TRAYLOR ENGINEERING & MANUFACTURING CO.
413 MILL ST., ALLENTOWN, PA.

Send bulletin 6121 which describes Traylor's Process Machinery

Name _____

Company _____

Address _____

SALES OFFICES: New York, N.Y.; Chicago, Ill; Los Angeles, Calif.
CANADIAN MFRS: Canadian Vickers, Ltd., Montreal, P.Q.

A "TRAYLOR" LEADS TO GREATER PROFITS

SOLID PORCELAIN

Lapp

PORCELAIN VALVE

● Valves of Lapp Chemical Porcelain are known in the chemical processing industry as the most effective for handling many corrosive chemicals. And *porcelain* is the body material itself, not a paint or enamel. The porcelain is dense, homogeneous, *non-porous, through-and-through* acid resisting. Not even is the corrosion resistance of this material due to a glaze. In fact, the smooth operation and pressure-tight seal is the result of machining—grinding and lapping the solid porcelain—which is finished to an accurate, mirror-like smoothness.

In many points in the chemical industry, Lapp valves have been found the only satisfactory answer to the problem of handling corrosive chemicals. Perhaps they can save trouble for you, too. Lapp Insulator Co., Inc., Process Equipment Division, 484 Maple St., LeRoy, N.Y.

Lapp

PROCESS EQUIPMENT

CHEMICAL PORCELAIN VALVES • PIPE • RASCHIG RINGS

PULSAFEEDER CHEMICAL PROPORTIONING PUMPS

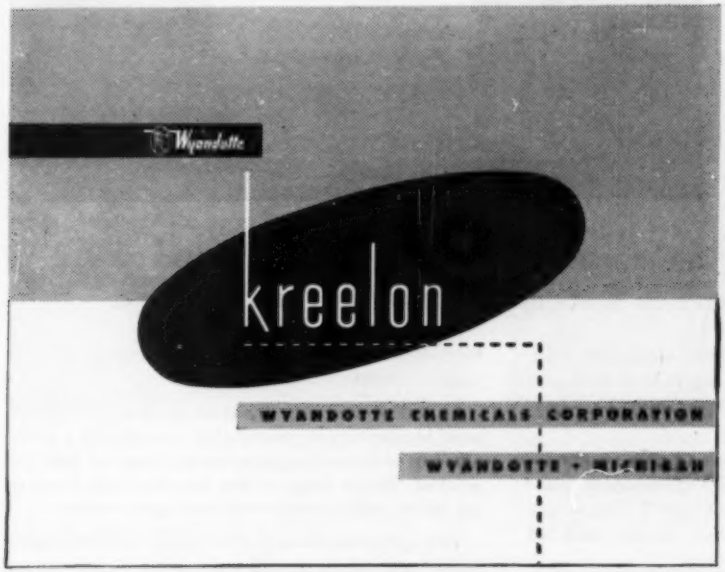
CHEMICAL PORCELAIN BULLETIN NOW AVAILABLE

Chemical and mechanical characteristics of Lapp Porcelain; specifications and dimensions for valves, pipe, raschig rings, towers; installation procedure and maintenance hints. Write for your copy.

If you're interested in . . .

Building Maintenance Cleaners	Insecticides
Car Washing	Leather Processing
Coal Mining	Metal Cleaning
Commercial Laundering	Paper Manufacture
Dishwashing	Rubber Processing
Fire Fighting	Rug and Upholstery Shampoos
Food Processing	Scouring Powders
Food Serving	Street Cleaning
General Household Cleaners	Textiles
	Toiletries

. . . you'll be interested in this new Kreelon booklet!



This new booklet brings you up on Kreelon*, Wyandotte's alkylarylsulfonate synthetic detergent. It packs practical information about Kreelon's physical properties, performance and applications. You'll find it helpful and useful. We have a copy ready to mail you — send for it and it will be on its way pronto.

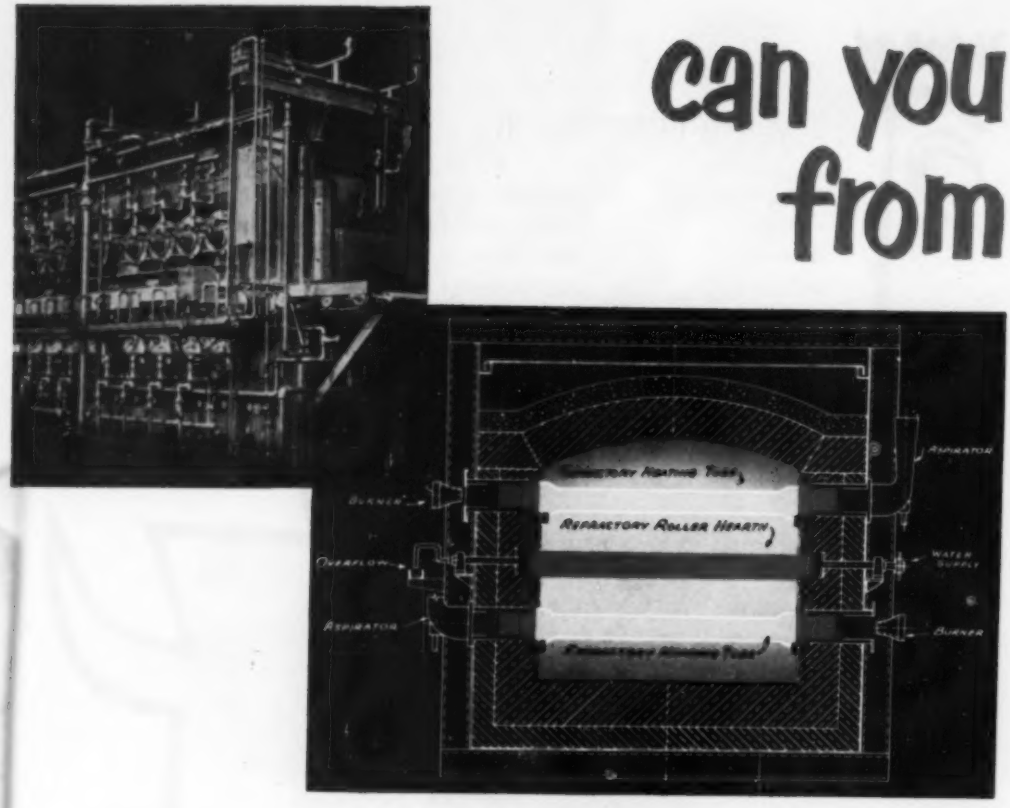
*Reg. U. S. Pat. Off.

Specifications and applications of Wyandotte Organic Chemicals are in the current Chemical Materials Catalog

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA
CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE
HYDROGEN • DRY ICE • SYNTHETIC DETERGENTS • GLYCOLS
CARBOSE (Sodium CMC) • ETHYLENE DICHLORIDE • PROPYLENE
DICHLORIDE • AROMATIC SULFONIC ACID DERIVATIVES
OTHER ORGANIC AND INORGANIC CHEMICALS

Wyandotte
REG. U. S. PAT. OFF.
CHEMICALS
WYANDOTTE, MICH.
Offices in Principal Cities

can you from



By using Super Refractories instead of alloys for radiant tubes and rollers, The Gas Machinery Co. opens up new applications for this furnace.

The furnace at the left is a controlled-atmosphere roller hearth furnace. Work, such as castings to be malleablized, moves through on rollers—is indirectly heated by radiant tubes above and below the hearth.

In furnaces of this type, the rollers and tubes are customarily made of heat-resisting alloy steel. Consequently, maximum operating temperature is about 1600 F. (Above this temperature, the strength and hardness of these steels fall off sharply.)

So, The Gas Machinery Company tried something different. Instead of metal, they used CARBOFRAX silicon carbide rollers and radiant tubes—a Super Refractory material made by CARBORUNDUM.

With these changes, temperatures of up to 2500 F, and more, become not only possible, but practical—and a whole new field of furnace usages opens up. Moreover, both the rolls and tubes last longer. In fact, the rollers (which used to sag and wear away) show hardly any signs of wear at all.

This application points up several properties of this highly unusual material. At elevated temperatures it *conducts* heat almost as well as heat-resisting alloy steels. It can be used at far higher temperatures than metals will stand—up to 3000 F

Super Refractories by

CARBORUNDUM

Trade Mark

Refractories Division — The Carborundum Company, Perth Amboy, N. J.

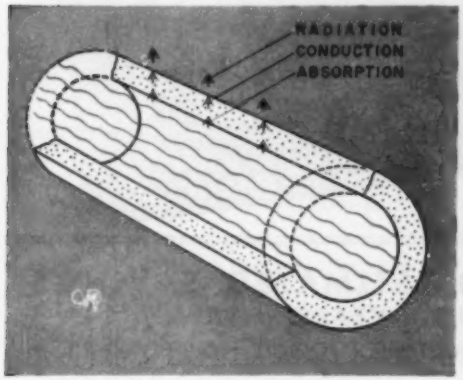
"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company

pick up any ideas this use of tubes?

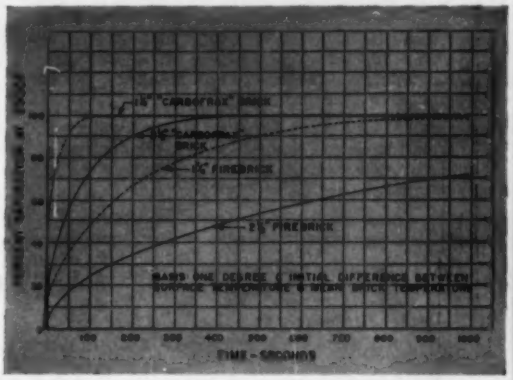
and higher. It doesn't scale, is very resistant to spalling and to heat shock. It is chemically inert—is little affected by the products of combustion—and is highly impervious to gases. It is also one of the most abrasion-resisting materials known. And it has the strength to support heavy charges, even at very high temperatures.

This illustrates the important thing about Super Refractories by CARBORUNDUM: They are not just "better" than standard fireclay refractories. They are actually a class apart—with distinctly different properties that have made possible distinctly new designs and processes. Once this concept is realized, possible applications are almost unlimited. The Gas Machinery Co., for example, now uses Super Refractories in several kinds of equipment, including an ingenious continuous catalytic gas reforming unit. Other companies also have developed interesting new equipment—designed around Super Refractories.

WHAT ABOUT YOUR OWN PROCESSES? We have a new booklet which outlines the unusual characteristics of these special-purpose materials. The coupon will bring you the story —or one of our engineers would be happy to talk over your specific problems. We believe it could be mutually profitable.



In indirect heating, absorption and emission factors come into play, as well as thermal conductivity. In both absorption and emission (and thus in radiating ability) CARBOFRAX tubes and shapes are superior to metal. They approach the high-temperature alloys in conductivity.



Thermal conductivity also plays an important part in checkers. A regenerator using CARBOFRAX brick for its checkerwork can be operated on much faster cycles—absorbing and releasing many times more BTU's per second. Also, higher temperatures, to above 3000 F if desired, become possible.

This advertisement — one of a series — is presented in the belief that in the unusual properties of Super Refractories by CARBORUNDUM lies the key to many new or improved processes. We would like to talk over specific jobs with anyone who sees such possibilities.

Dept. H-121
Refractories Div., The Carborundum Co.
Perth Amboy, New Jersey
Please send your free booklet on properties of Super Refractories.

Name_____
Position_____
Company_____
Street_____
City_____ **Zone**____ **State**____

NOTES for Process Engineers

C. H. Wheeler OF PHILADELPHIA

COOLING TOWERS—VACUUM REFRIGERATION—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE REDUCTION MILLS—STEAM CONDENSERS—STEAM JET EJECTORS—MARINE CONDENSERS & EJECTORS—DECK MACHINERY

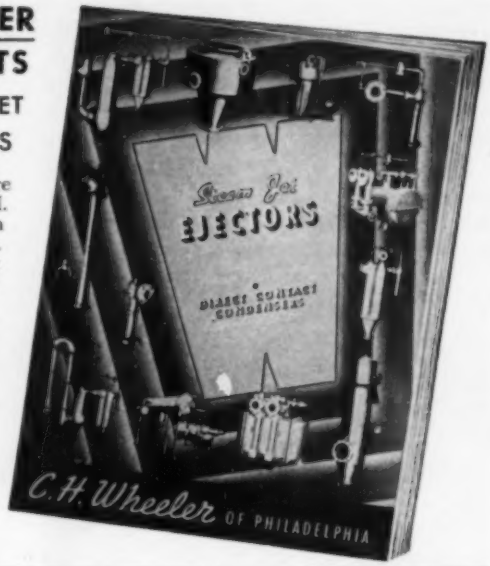
YOU MAY BE ABLE TO LOWER YOUR REFRIGERATION COSTS

INVESTIGATE C. H. WHEELER STEAM JET VACUUM REFRIGERATION SYSTEMS

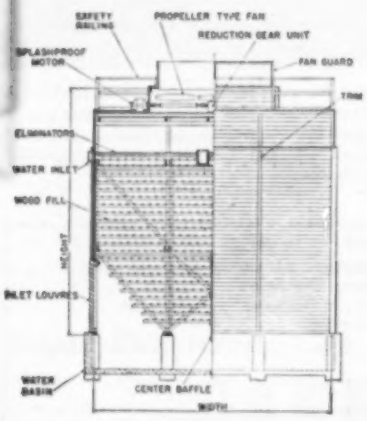
Where your chilled water temperature requirements are 35° to 65° F and you have live steam available, C. H. Wheeler engineers are experts at effecting refrigeration savings. They work out hook-ups of standard C. H. Wheeler Steam Jet Vacuum Units that afford lowest first cost, lowest installation cost and lowest maintenance cost.

C. H. Wheeler pioneered and has been a leader for many years in the installation of Steam Jet Vacuum Refrigeration Systems . . . for finishing rolls in the paper and rubber industries, for sulphite mills and other places employing acid recovery apparatus of the absorption type, for distillation processes in oil refineries, and for many phases of food processing.

A 36-page book on C. H. Wheeler Steam Jet Ejectors will be mailed you on request. It will augment your store of knowledge on the subject and suggest cures for "refrigeration headaches" in your plant.



Induced Draft Cooling Tower of Redwood Construction

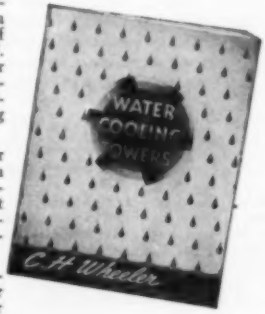


$13,500 ESTIMATED SAVINGS IN 6 YEARS WITH A C. H. WHEELER COOLING TOWER

A C. H. Wheeler customer worked out his own engineering estimate of the savings assured through the purchase of a 3-cell C. H. Wheeler Cooling Tower of 12,500 GPM capacity. He chose C. H. Wheeler over a competitive 2-cell tower costing $10,000 less. The greater efficiency of C. H. Wheeler tower engineering results in estimated yearly operating savings of $2,261.

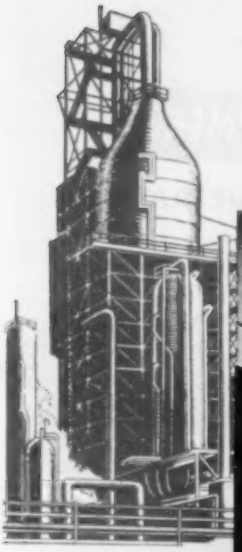
The formula employed by the customer and a tabulation of his figures has been reproduced for your appraisal. This, together with Catalog 145, will augment your knowledge of cooling tower operation. A request on your company letterhead will bring them by return mail.

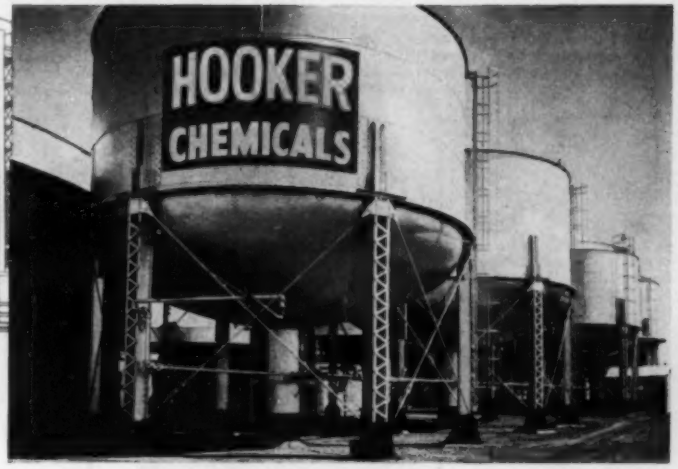
Be sure to call a C. H. Wheeler representative early in your cooling tower plans. He shows you where to check for features of quality.



C. H. WHEELER MANUFACTURING CO., 1808 SEDGLEY AVE., PHILADELPHIA 32, PA.

Petroleum Refiners, too specify HOOKER





HOOKER CAUSTIC SODA distributing station at Wilmington, Calif., serves refiners in the area.

HOOKER CHEMICALS USED BY THE OIL INDUSTRY

Caustic Soda	Aluminum Chloride
Chlorine	Antimony Trichloride
Muriatic Acid	Sulfur Chlorides

Refiners use *Hooker Caustic Soda* for sweetening base stocks, and for neutralizing chemical wastes. They specify *Hooker Chlorine* for water treatment. *Hooker Muriatic Acid* is used for treating wells to improve production.

The other Hooker Chemicals listed above find wide use as catalysts in isomerization, polymerization, and treatment of hydrocarbon oils.

DELIVERIES

—Most of the Hooker Chemicals listed here are available now; some in limited quantities. Others will be available in the near future. Your Hooker sales representative will be glad to keep you posted on the current delivery situation.

Why Hooker is a good supply source for *Your Industry*

Hooker offers you:

- a selection of nearly 100 industrial chemicals
- exceptional purity that reduces processing headaches
- uniformity assured through rigid control methods
- shipments carefully checked to arrive in good order, on schedule
- convenient location, with plants serving the industrial East and West
- willing technical help on problems of supply
- experience as a supplier to 30 different industries

Write today, on your business letterhead, for General Products List 100, and for Technical Data Sheets on Hooker Chemicals of particular interest to you.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

5 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.

NEW YORK, N. Y. • WILMINGTON, CALIF. • TACOMA, WASH.

HOOKER CHEMICALS

1-1430

SODIUM SULFIDE • SODIUM SULFHYDRATE • BENZAL CHLORIDE • BENZOIC ACID • BUTYRYL CHLORIDE • LAURYL CHLORIDE • SULFURYL CHLORIDE

Check

THIS DEPENDABLE McLANAHAN EQUIPMENT

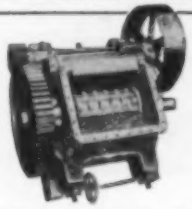
FOR ECONOMICAL PIT, MINE and QUARRY OPERATIONS

For more than a century, McLanahan equipment has served pits, mines and quarries of America and foreign countries . . . for crushing, washing, sizing and conveying all types of ore, coal and rock. The equipment illustrated shows the wide variety of products we build. Additional data gladly sent upon request.

All Steel Rockmaster Single Roll Crusher for primary or secondary work on rock and ore.

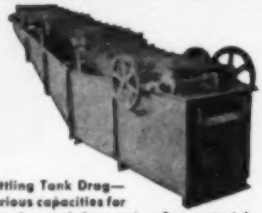
Special Heavy Duty Reciprocating Feeder—Handles any material from sand sizes to shovel loaded rock and ore.

Steel Paddle Mill Scrubber—high capacity for cleaning large size feed.

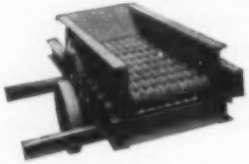


Automatic Steelstrut Crusher for primary and secondary work in small plants.

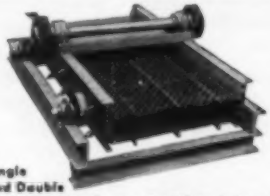
Fabricated Black Diamond Double Roll Crusher for secondary reduction.



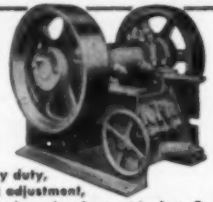
Settling Tank Drag—various capacities for cleaning and dewatering fine materials.



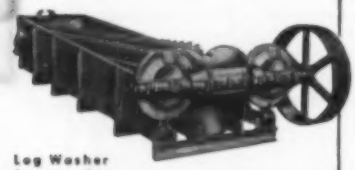
Heavy Duty live roll Grizzley for sizing and feeding various products.



Single and Double Deck Vibrating Screens in different sizes.

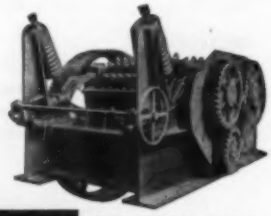


Heavy duty, quick adjustment, all steel overhead eccentric Jaw Crusher, for primary and secondary work in small plants.



Log Washer for removing tough clay and soft rock from various materials.

Double duty combination Scrubber and Sizing Screen for large and small capacities.



Fabricated Steel Swing cage Double Roll Crusher—Quick Adjustment—without change of gears. Tramp Iron Protection.

Write today for literature on dependable McLanahan equipment for your application.

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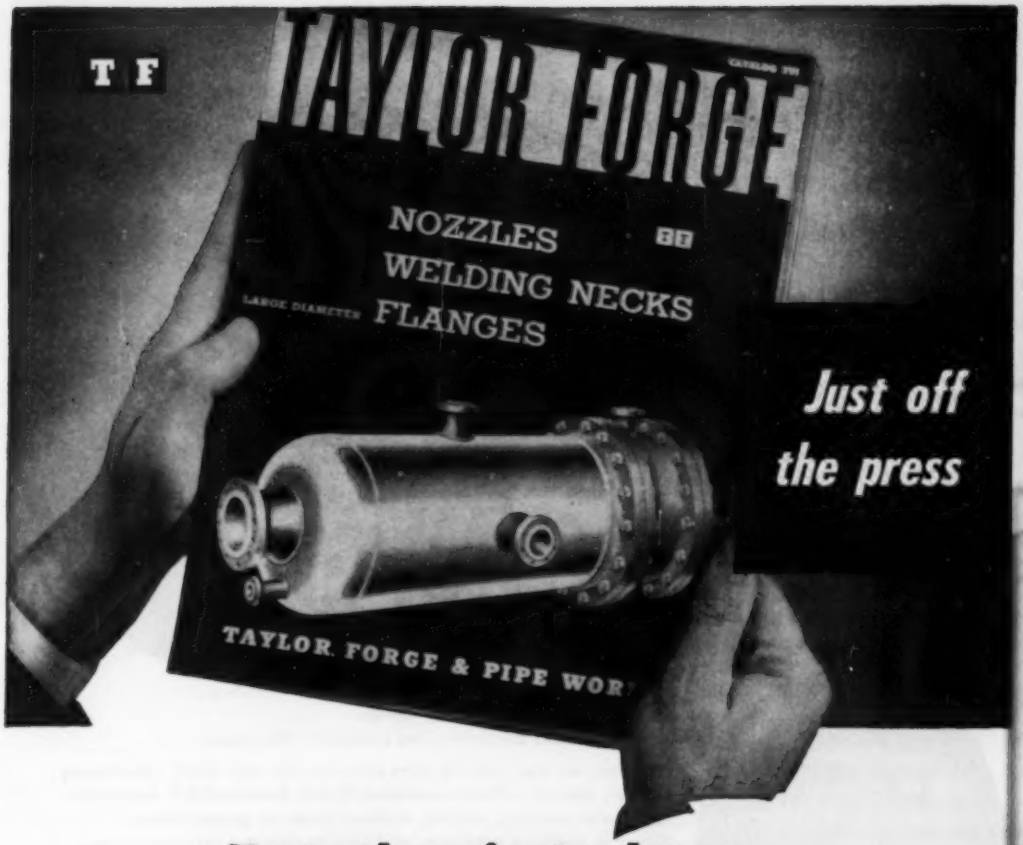
Pit, Mine and Quarry Equipment Headquarters Since 1835

Hollidaysburg, Pennsylvania

Dependable Products: Single and Double Roll—and Jaw Crushers, Crushing Plants, Reciprocating Plate and Apron Feeders, Roll Grizzlies, Conveyors, Elevators, Screens, Scrubbers, Steel Log Washers, Sand Drags, Hoists, Jigs, Dry Pans, Dryers, Scrap Bundlers, Pulleys, Gears, Bearings, Sprockets, Sheaves, Rollers, Bin Gates, Elevator Buckets, Gratings, Car Wheels, Ferrous and Bronze Castings.



Up-to-the-minute data on pressure vessel outlets

IN THIS new Pressure Vessel Catalog 501 you will find the latest data covering pressure vessel outlets compiled as you would expect it to be by the originators of forged and rolled steel welding necks and nozzles.

The pages include up-to-the-minute information on seamless steel nozzles, welding necks, manways, and large diameter flanges for boilers, heat exchangers, and other pressure vessels. Of particularly timely importance are data covering standards of Tubular Exchangers Manufacturers Association (TEMA Standards). A useful section on modern flange design covers codes, materials, and design procedures with typical calculation forms and examples of calculation.

This 118 page book is available without charge to anyone having a specific interest in outlets for pressure vessels. To obtain your copy see your Taylor Forge Distributor or **MAIL THE COUPON.**

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago 90, Ill.

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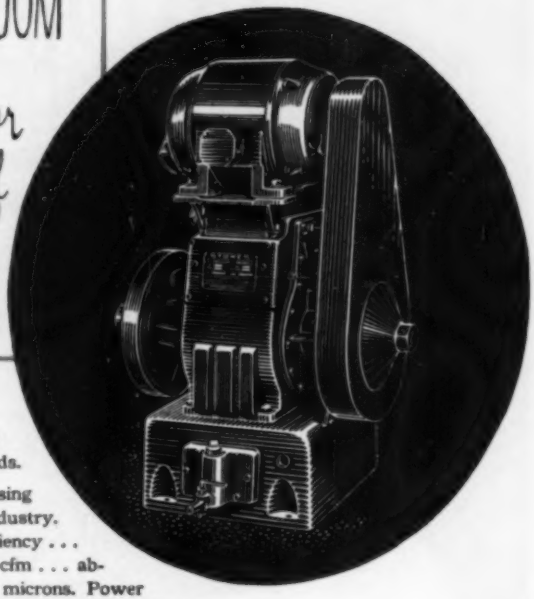
CITY_____ ZONE____ STATE_____

P.P. Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

STOKES HIGH VACUUM EQUIPMENT... for every requirement of vacuum processing



Modern design of Stokes vacuum equipment develops from the continuing contact of Stokes Engineers with processors in many fields.

Stokes Microvac Pumps — basic to vacuum processing —are designed for the broadest requirements of industry. They have high volumetric and mechanical efficiency . . . capacities of 15 to 500 cfm . . . absolute pressures to 10 microns. Power consumption is low. Compact design with top-mounted motor requires minimum floor space.

There are but four moving parts including the high speed, full-opening exhaust valve of corrosion-resistant Teflon. Lubrication is completely automatic, without packing, stuffing-boxes or grease fittings. Wear is kept to a minimum, and long trouble-free service assured. Parts are precision-finished, standard and interchangeable.

Stokes is the only manufacturer of equipment for complete vacuum systems, including Microvac mechanical pumps, oil diffusion pumps, McLeod Gages and Vacuum Valves.

Send for FREE Stokes Vacuum Calculator. This slide rule determines needed pump capacity for any job . . . shows Centigrade to Fahrenheit conversion. Other useful conversion tables and scales on reverse of rule.

Consult with Stokes on the application of vacuum to drying, freeze-drying, impregnating, extraction, solvent recovery, distilling, evaporating, vacuum metallizing, and to other applications in which vacuum deserves exploration.

STOKES MAKES
Plastics Blending Presses,
Industrial Tableting
and Powder Metal Presses,
Pharmaceutical Equipment,
Vacuum Processing Equipment,
High Vacuum Pumps and Gages,
Special Machinery

STOKES

F. J. STOKES MACHINE COMPANY, 5500 TABOR ROAD, PHILADELPHIA 20, PA.

A "K" Monel doctor blade in use on a soap flaker dryer roll. After 7 months of highly satisfactory service, this blade was transferred to rolls used for polishing soap, setting a record for doctor blade longevity in the plant.

The Doctor Was a Headache
...until they tried "K" MONEL

In a soap flake plant, flaker roll doctor blades were a source of considerable trouble and expense.

The blades were operated against a cast iron cooling roll, 5 ft. in diameter with a 90 in. face, which handled 72,000 pounds of soap every 24 hours.

Although made of the finest Swedish steel, doctor blades had to be honed every hour, and reground every 24 hours. It took only ten minutes to change a blade, but in that short time 500 pounds of soap production were lost.

After putting up with the problem for some time, plant engineers decided to try doctor blades made of "K" Monel®.

Results? Judge for yourself! Here is what the plant engineers reported:

1. "K" Monel doctor blades (0.031 in. thick by 4 in. wide) required honing only once in 24 hours.

2. "K" Monel blades gave 27 continuous days of service before needing regrinding.

3. It took more than 7 months to reduce the width of a "K" Monel blade from 4 in. to 2¾ in.

Switching to "K" Monel doctor blades gave them 24 times more service between honings, 9 times more service between regrinds, and saved uncalculated production poundage formerly lost through frequent blade changes.

Not always, of course, can such spectacular gains be made merely by changing the material of a doctor blade. But here's something to remember—

There are special Inco Nickel Alloys for almost every doctor blade application . . . alloys that have a proved record of reducing maintenance costs and speeding production

Find out more about these important alloys by asking for your copy of: "How to Get More Production from Doctor Blades." Right now, of course, INCO Nickel Alloys are being diverted more and more to defense production, so you may have to wait for the metal you want.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

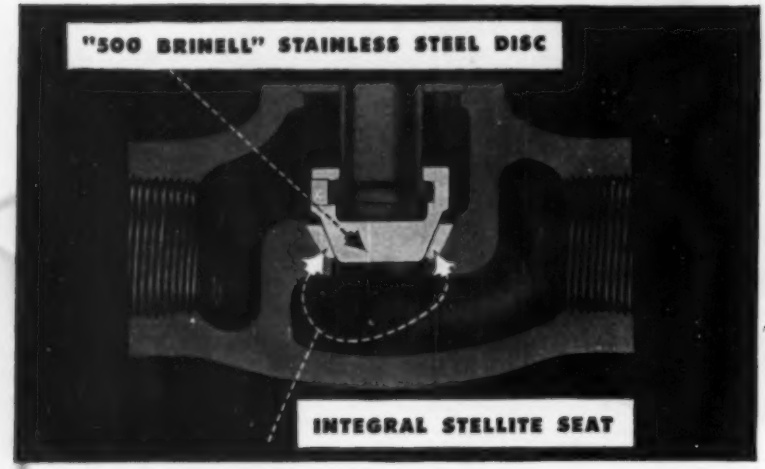
EMBLEM OF SERVICE
NICKEL INCO **ALLOYS**

MONEL® • "K"® MONEL • "KR"® MONEL • "R"® MONEL • "S"® MONEL
NICKEL • LOW CARBON NICKEL • DURANICKEL®
INCONEL® • INCONEL "X"®.

IN THERE . . DELIVERING ALL THE TIME!

600# Hancock Steel Weldvalves

END VALVE SEAT LEAKAGE AND REPLACEMENT!

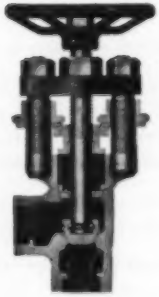


GLOBE TYPE

SIZES
¼" through 2"—Screwed and Socket Weld Ends.

SERVICE RATINGS

W.S.P.	600#	850°F.
O.W.G.	2000#	100°F.



ANGLE TYPE

Long, trouble-free service life—that's the record wherever Hancock Steel Weldvalves are installed. Integral stellite seat and "500 Brinell" stainless steel disc—accurately finished, perfectly aligned—provide permanent leak-proof tightness between body and seat. Seats never need be replaced. No wire drawing, galling, steam cutting, erosion, or corrosion.

CHECK THESE OTHER 600# HANCOCK WELDVALVE FEATURES:

Maximum Use of Welding adds strength, eliminates needless joints—the most common cause of leakage, gasket troubles and high maintenance costs.

Stainless Steel Ball Bearing Stem-to-Disc Connection for longer wear, even distribution of load, easy operation.

Corrosion-Resistant Back Seating permits stuffing box shut-off around the stem with valve fully open.

Extra-Strong Upper Structure—far stronger than conventional designs.

Yoke Post and Gland Nut Threads Protected permanently—always workable.

Streamlined, Compact Design saves space, permits close alignment of piping with near structures.

Special Treatment resists corrosion of valve exterior.

Hancock Valves cost no more than ordinary valves, despite their outstanding design, operating advantages and unlimited service life. So, get the best for your money—specify Hancock Valves. *When Hancocks Go In, Valve Costs Go Down.*

FOR PROMPT SERVICE, contact your nearby Hancock Valve Distributor.

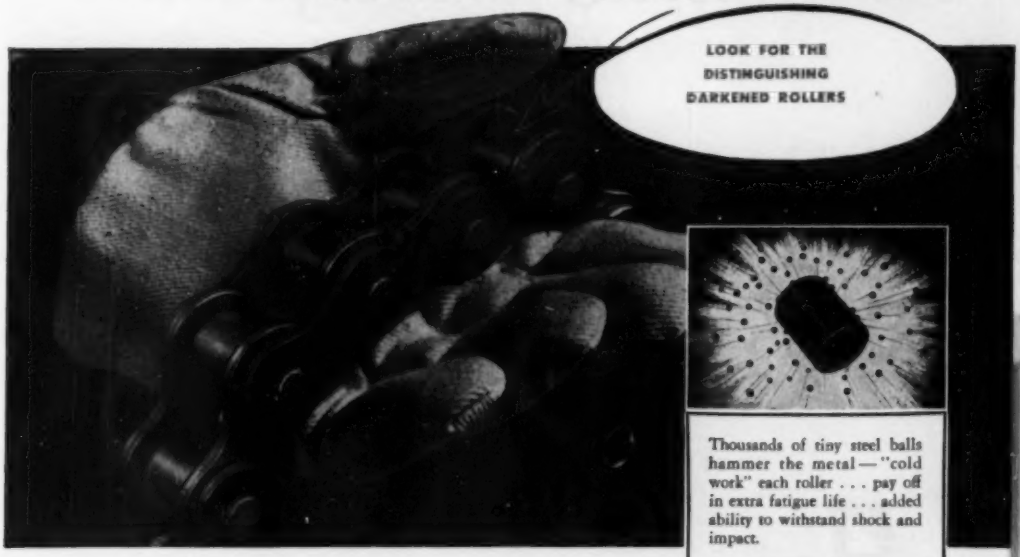
1877 HANCOCK U.S.A.

HANCOCK VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** WATERTOWN 72, MASSACHUSETTS

MAKERS OF 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, BUILDERS OF "SHAW-BOX" CRANES, "BUDGIT" AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

Here's how you can tell the chain with SHOT-PEENED rollers...



Thousands of tiny steel balls hammer the metal — "cold work" each roller . . . pay off in extra fatigue life . . . added ability to withstand shock and impact.

...the chain that has extra fatigue life

YES, you want to be sure you get shot-peened rollers on the next roller chain you buy. Shot-peening gives rollers the extra fatigue life needed to take repeated shock and impact loads.

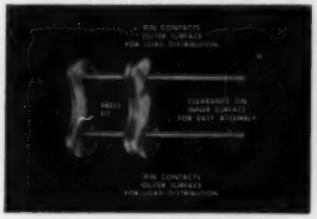
These chains are high in tensile strength, durable under severe loads, relatively light in weight and uniform in pitch. This accounts for their wide acceptance throughout industry for both drive and conveying purposes.

Thanks to constant research and precise manufacturing controls, every Link-Belt Precision Steel Roller Chain meets the highest standards for uniform strength. You get a positive, long-life drive — unaffected by heat, cold or moisture.

Link-Belt Roller Chain is available in single or multiple widths, in ⅜ to 3 in. single and double pitch. For all the facts, call your nearest Link-Belt office.

LINK-BELT

PRECISION STEEL ROLLER CHAIN



Easier coupling
and uncoupling without sacrificing load distribution

Patented E-Z Assembly feature of Link-Belt Precision Steel Roller Chain has won world-wide approval. Coupling and uncoupling of multiple width chains — right on the job — is far easier. There's absolutely no sacrifice of load distribution . . . no loss of the chain's remarkable performance. Press-fits between chain pins and middle bars have been modified. But full load carrying capacity across the entire width of the chain has been maintained.

LINK-BELT COMPANY: Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in principal cities. 12,300

IN ION EXCHANGE...

these 3 Graver features give you best results

1

LABORATORY RESEARCH

Graver chemists and technologists are continuously evaluating the performance of more than 40 ion exchangers. The result . . . *Graver has the correct ION EXCHANGER* for your particular needs.

2

PILOT PLANT OPERATION

Graver development engineers regularly conduct tests on small-scale pilot units operating under simulated plant conditions. The result . . . Graver *has the most practicable ION EXCHANGE PROCESS* for your particular needs.

3

SUCCESSFUL INSTALLATIONS

Graver water-treating and liquid-conditioning equipment has been accomplishing desired performance for more than 30 years. The result . . . Graver *has the most efficient ION EXCHANGE EQUIPMENT* for your particular needs.

These are some of the reasons why, when you consult Graver's trained engineers about your ion-exchange problems, you can be sure of an ion-exchange installation that will give you uniformly dependable service with lowest chemical regenerating costs and greatest ease of operation.

Write for the following reprints:

- "Operating Experience with Resin Zeolites on the Hydrogen Cycle"
- "Present Practices in the Use of Ion Exchangers in Water Treatment"
- "Silica Removal by a Practical Ion Exchange Process"

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

216 WEST 14TH ST., NEW YORK 11, N. Y.

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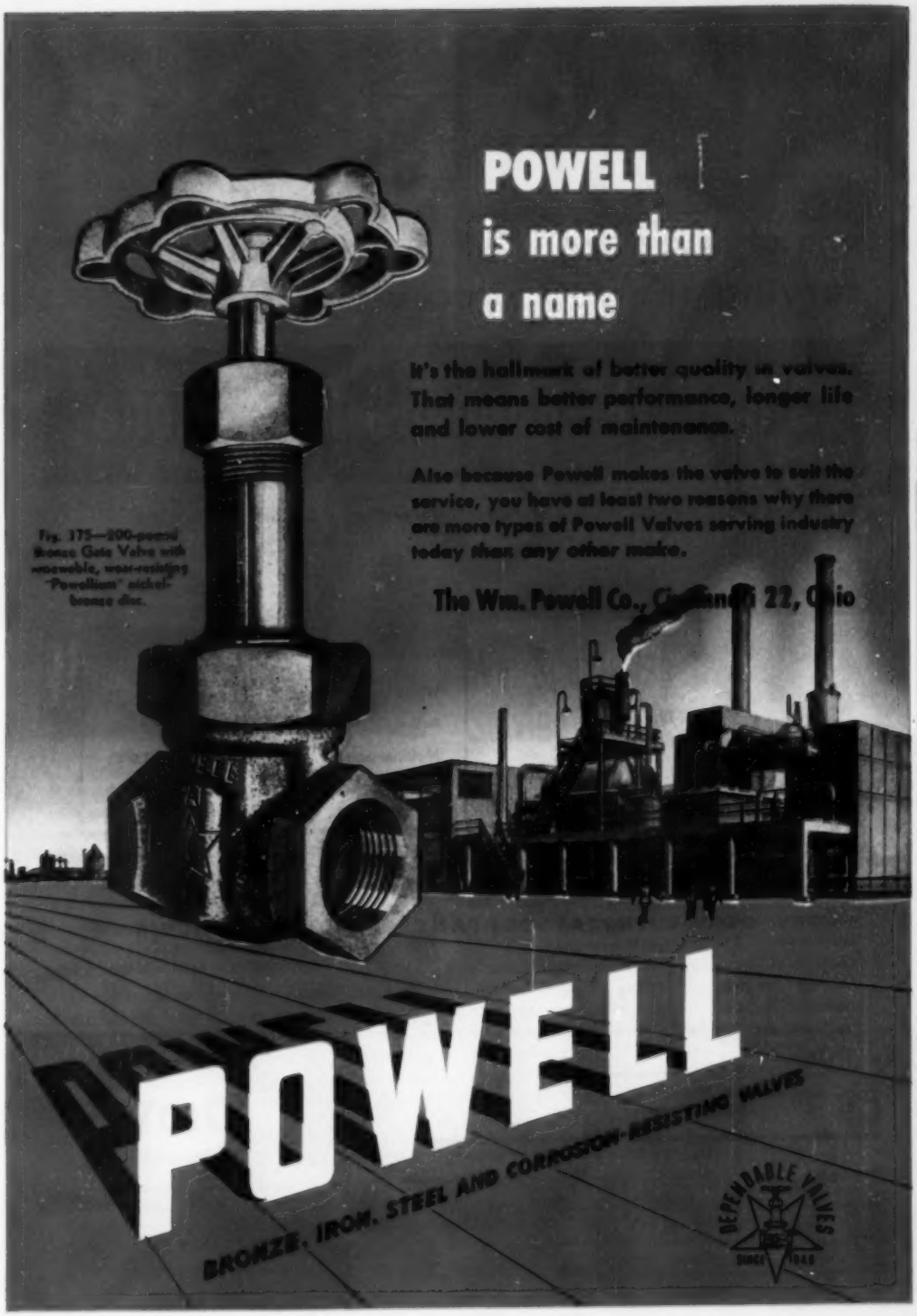
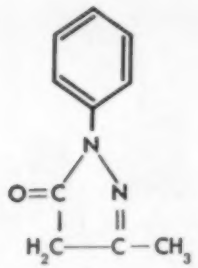

POWELL
is more than
a name
It's the hallmark of better quality in valves. That means better performance, longer life and lower cost of maintenance.
Also because Powell makes the valve to suit the service, you have at least two reasons why there are more types of Powell Valves serving industry today than any other make.
The Wm. Powell Co., Cincinnati 22, Ohio
Fig. 175—200-pound Bronze Gate Valve with renewable, wear-resisting "Powellium" nickel-bronze disc.
POWELL
BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES
DEPENDABLE VALVES
SINCE 1846

one of many **DOW** chemicals
serving the Pharmaceutical Industry

3-Methyl-1-Phenyl-5-Pyrazolone

Used in the preparation of pharmaceuticals and as a dye intermediate.



PROPERTIES
White to slightly yellow powder
Boiling point at 17 mm. Hg.....191°C.
Melting point.....128.9°C.
Molecular weight.....174.2

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

Send for Experimental Sample

The Dow Chemical Company
Dept. FC-2A
Midland, Michigan

Please send me an experimental sample of 3-Methyl-1-Phenyl-5-Pyrazolone.

Name_____ Title_____

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Street_____

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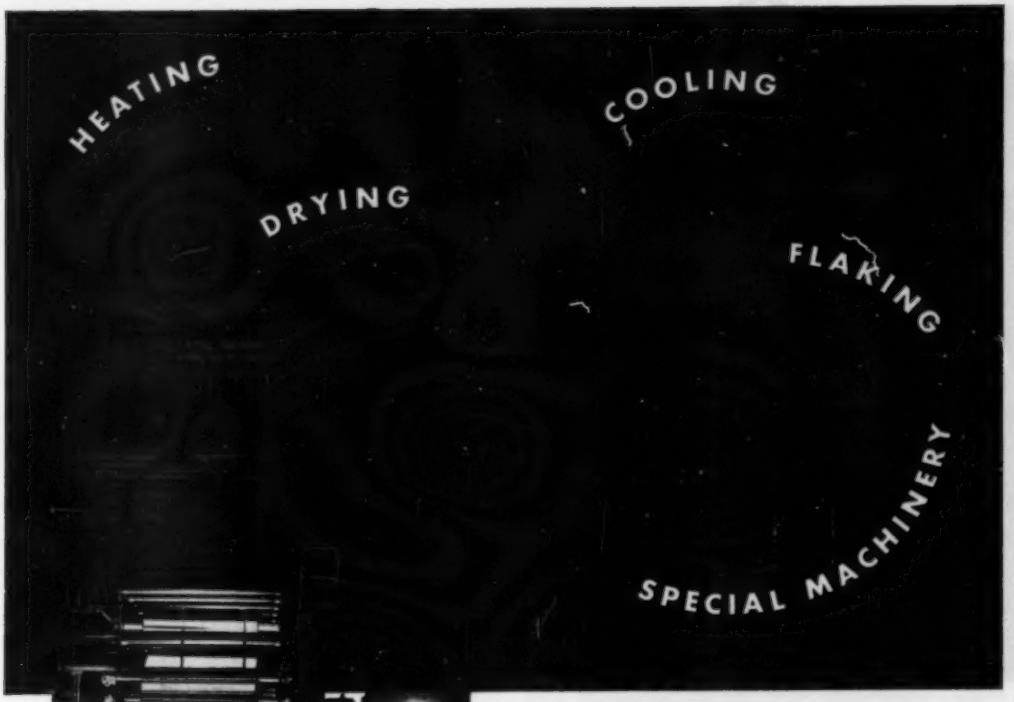
DOW
CHEMICALS
INDISPENSABLE TO INDUSTRY AND AGRICULTURE



We Specialize in Solving Mysteries

If the mystery's in your machinery—extorting payment after payment in heavy maintenance and long production lags—chances are Lukenweld can help.

Consider the processor who came to Lukenweld recently with a puzzle you might have. His involved special machinery for laminated sheet production. Down-time had cut into his profits and a new machine was required.

To solve his problem, Lukenweld supplied a steam-heated rotary press for continuous production, with all parts in easy, instant reach . . . saving the manufacturer days of costly maintenance and cutting his down-time 50%. A modern hydraulic system facilitates pressure adjustments... taking waste motion out of this processing job. A top quality product is now competitively produced.

If old equipment is cutting your production . . . interfering with product quality, wasting man hours in down-time, causing high maintenance . . . it will pay you to send for a Lukenweld engineer, experienced in analyzing production requirements. He will show you how precision machinery of improved design can help increase your production, lower your unit costs, improve plant efficiency. Why not write today? Lukenweld, Division of Lukens Steel Company, 400 Lukens Building, Coatesville, Pennsylvania.

Improved machinery for improved processes through engineering

LUKENWELD

A DIVISION OF LUKENS STEEL COMPANY

LUKENS

A DIRECT-CURRENT AMPLIFIER
for use with a 5-Milliampere Recorder

☆ *Recording D-C Milliammeter Or Voltmeter*

☆ *Measuring emf of Electro-chemical Cells* ☆ *Recording Sound and Vibration*

☆ *Recording Variations in Insulation Resistance during Dehydration*

☆ *Recording Frequency and Modulation Levels of Broadcast Transmitters*

☆ *Operation from Resistance Thermometers, Photo Cells, Strain Gauges*

☆ *Process Control* ☆ *Measurements in Physical and Chemical Laboratories*

The Type 715-AE D-C Amplifier was designed particularly for operation with the standard Esterline-Angus Company 5-milliampere Recorder for applications similar to those suggested above.

This amplifier has high gain and very good stability of calibration. It has four calibrated ranges each giving 5 ma linear output in the recorder circuit of 1000 ohms, for input voltages of 0.1, 0.2, 0.5 and 1.0 volt across the input terminals with either polarity.

Its calibration accuracy as a voltmeter is approximately 1% of full-scale. A number of input resistances are selected by a switch for resistances between 100 ohms and 10 megohms, so that the amplifier not only has an adjustable input resistance but also can be used as a calibrated millivoltmeter or microammeter.

Over room conditions normally encountered, operation and stability are independent of ambient temperature or changes in relative humidity.

Type 715-AE *D-C Amplifier (Illustrated) in metal case to match Esterline-Angus Recorder (Recorder not included)* **$365.00**
Type 715-AM *D-C Amplifier in Walnut case* **$370.00**

GENERAL RADIO Company
275 Massachusetts Avenue, Cambridge 39, Mass.

STROBOSCOPES • VARIACS • SOUND-LEVEL METERS
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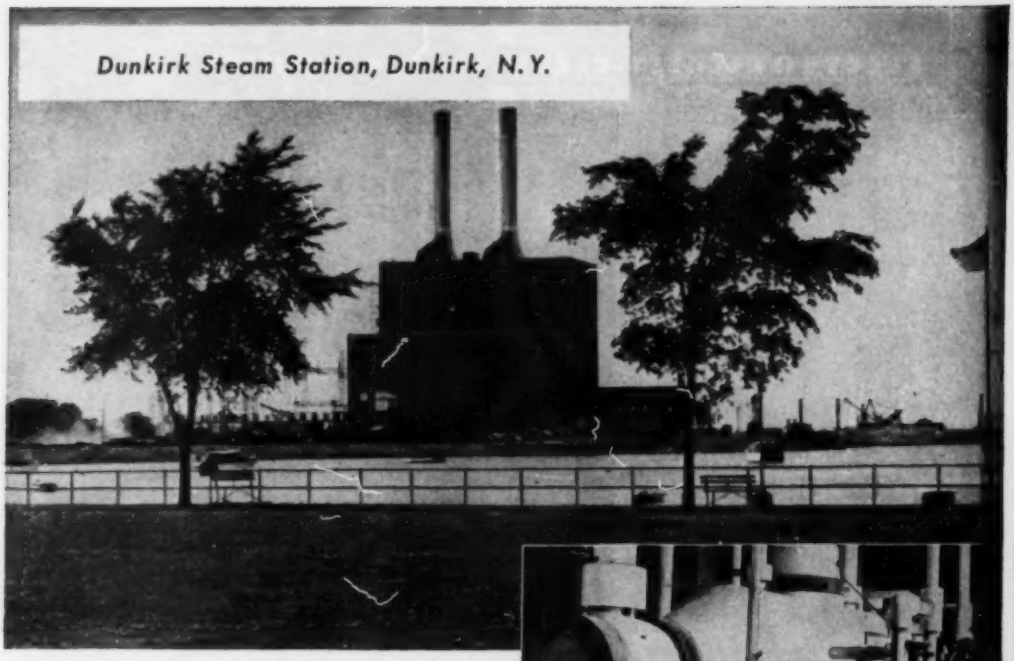
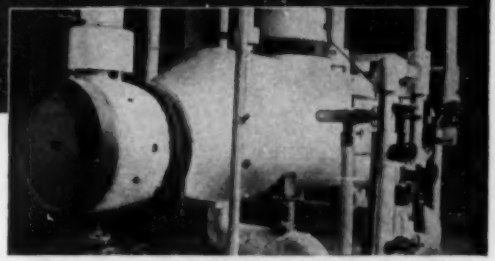
Since 1915—Designers and Manufacturers of Electronic Test Equipment





ALCO *Evaporator on the job at Dunkirk. Extracted steam is delivered to the tubes at 72 psia and 285° superheat to produce 16,400 pounds per hour of net vapor.*

How Alco Evaporators give this station

High purity make-up water

Typical of the effective engineering which keynotes the design of this 160,000 kw plant of the Niagara Mohawk Power Corporation, are the two ALCO evaporators, each of which furnishes 20,000 pounds per hour of high purity make-up water for the two 80,000 kw generating units.

These single-effect evaporators are of the ALCO patented "Flextube" thermal descaling type. Each evaporator contains 586 square feet of effective heating surface comprising 80-20 Cupro-nickel tubing, and uses a centrifugal type vapor purifier. Maximum working pressure for the shell side is 100 psig; for the tube side, 150 psig.

Other ALCO equipment in this new station includes high pressure extraction feedwater heaters, drain coolers, and evaporator condensers—all playing an important part in maintaining peak efficiency in this reheat cycle plant.

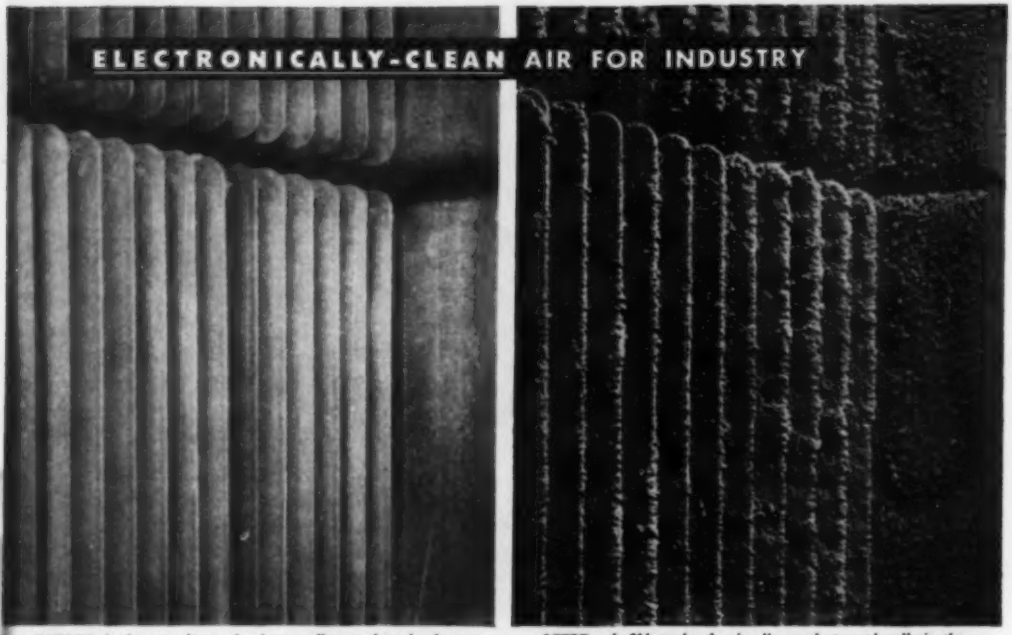
Check these other ALCO *Evaporator design features:* ample vapor disengaging space . . . separate, removable channel and cover . . . patented ALCO compression bolting. All add to the effectiveness of the evaporator. Write now for more details, or call the nearest ALCO Sales Engineer at Chicago, Houston, Kansas City, Los Angeles, New York or Tulsa. Plants: Dunkirk, N. Y. and Beaumont, Texas.

ALCO

ALCO Products Division

AMERICAN LOCOMOTIVE COMPANY

***In step with tomorrow*—ALCO AIRCOOLERS, Heat Exchangers, Evaporators, Feedwater Heaters, Pressure Vessels, Pipe**



BEFORE A close-up shows aluminum collector plates in clean PRECIPITRON cells. This is the way they appear after periodic washings, which dispose of the trapped air-borne particles.

AFTER only 2½ weeks cleaning "normal atmosphere" air, the same plates had accumulated this much dirt. PRECIPITRON stops air-borne dirt, soot, pollen, oil mists.

Precipitron® — ELECTRONIC BARRIER AGAINST INVISIBLE DIRT

Air that's "fit to breathe" *isn't* clean enough. A particle of invisible air-borne dust, no larger than 1/100,000 of an inch, can create an image on a bombsight behind which a battleship might hide. Minute corrosive particles will mar the super-finished surface of a vital engine part. Contamination by bacteria-carrying specks is dangerous in hospitals, laboratories or food processing plants. In industrial and commercial buildings, in industrial processes, in communication centers, stores, offices, and even the home—dirt is costly everywhere.

But PRECIPITRON—the electronic air cleaner—will take *all* the dirt out of the air, down to particles so tiny that they can be seen only with an Ultra Microscope!

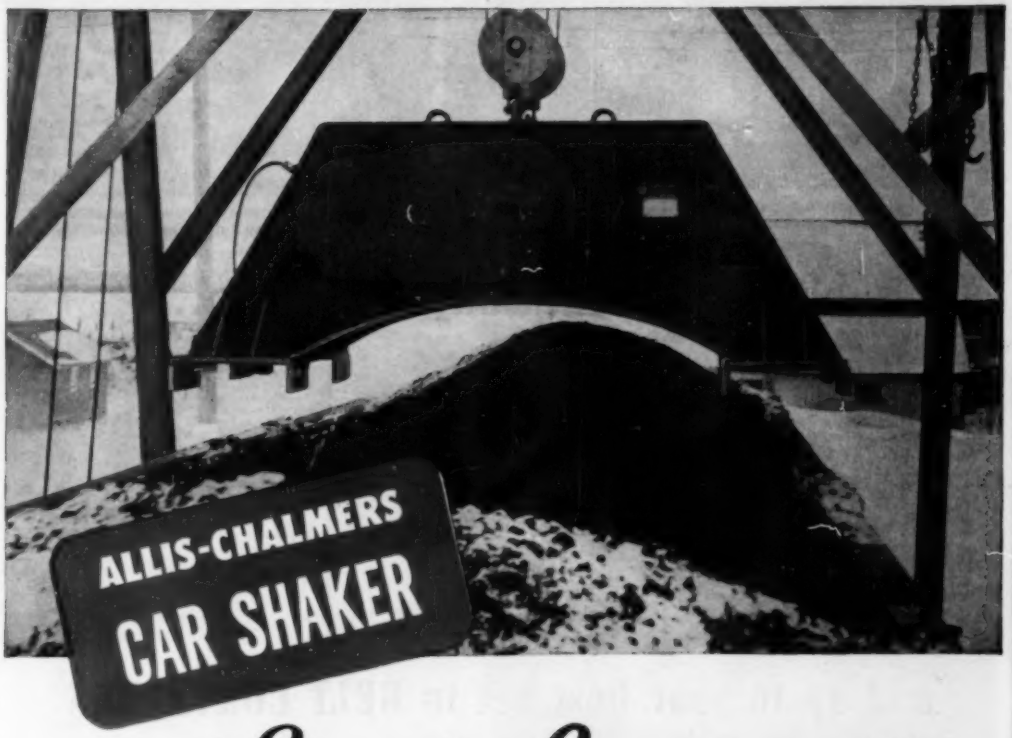
If you wish to add electronic air cleaning to your present systems—or if you wish to *put air to work* with Sturtevant air handling or air conditioning apparatus incorporating electronic air cleaning—contact your local Westinghouse-Sturtevant Office; or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

YOU CAN BE SURE...IF IT'S **Westinghouse**

ELECTRONIC *Air* CLEANING FOR:

J-80237

FAST UNLOADING



...and Sturdy Construction

BESIDES BIG SAVINGS in man-hours and demurrage costs, operators report savings in maintenance and downtime with Allis-Chalmers car shakers. And no wonder! Allis-Chalmers has designed these units for long, dependable service without trouble. For example:

- Shaker body is one-piece, all-welded structure made of 1 in. thick reinforced steel plate and stress-relieved to eliminate welding strains.
- Motor and drive are totally enclosed within shaker body, protected from weather and accidental injury. Motor is mounted in a special cradle base and protected from vibration damage with multiple shear mountings.
- Extra large bearing — 11⅞ in. outside diameter. Long bearing life! Heavy duty shaft arranged for hydraulic bearing removal.

Get more facts about how Allis-Chalmers car shakers can save money in your operations. Call the A-C representative in your area. Allis-Chalmers, Milwaukee 1, Wisconsin.

Car Shakers Promote Safety to Personnel!

ALLIS-CHALMERS

Allis-Chalmers Mfg. Co.
Milwaukee 1, Wis.

Please send my copy of Car Shaker Bulletin 07B7221A.

Name .....

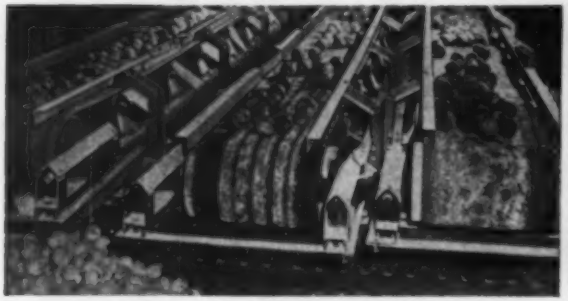
Title .....

Firm .....

Address .....

City ..... State .....

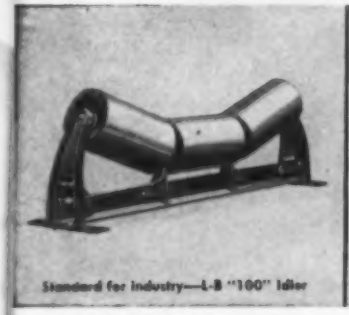
LINK-BELT engineering experience...



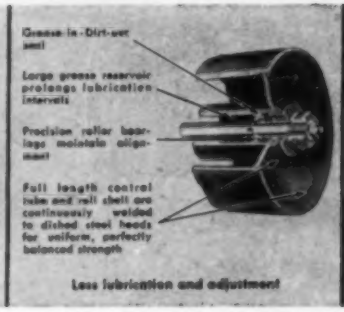
Link-Belt Flat Belt Conveyors transferring balls of water treatment compound from presses to storage bins.

Convenient Link-Belt drop spouts discharge silica sand from silos to troughed belt conveyor for delivery to grinding mill.

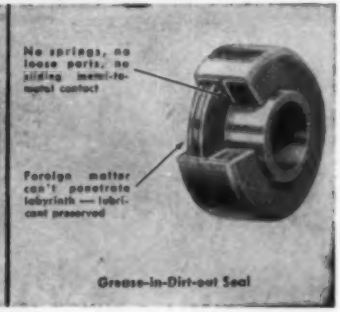
plus LINK-BELT quality components...



Standard for Industry—L-B "100" Idler


Grease-in-Dirt-out seal
Large grease reservoir prolongs lubrication intervals
Precision roller bearings maintain alignment
Full length central tube and roll shell are continuously welded to dished steel heads for uniform, perfectly balanced strength

Less lubrication and adjustment


No springs, no loose parts, no sliding metal-to-metal contact
Foreign matter can't penetrate labyrinth — lubricant preserved

Grease-in-Dirt-out Seal

add up to your best bet in BELT CONVEYORS

LINK-BELT Belt Conveyors provide dependable, efficient travel for many different materials

Get the finest in belt conveyor equipment in your plant. It can be as simple as calling in a Link-Belt engineer while you're still in the planning stage.

Thousands agree Link-Belt builds the finest belt conveyors on the market today. More, it has the most complete line of components—all types and sizes—idlers, take-ups, pulleys, trippers, bearings and power transmission drives. Plus all related equipment—other types of conveyors, feeders, elevators, car dumpers and shakers, weigh larries.

Equally important, Link-Belt Belt Conveyor engineers can draw on the broadest material handling experience in industry. They'll work with you and your consultants—help you come up with the right system for your requirements.

Call or write the Link-Belt branch office nearest you for the services of a belt conveyor expert.

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in Principal Cities. 12.250-21

Want maximum tube life per dollar spent? Ask the experts!

OF all the high temperature tube steels made, only *one* can give you the best life/cost ratio. But how to select the *one right* steel from more than 20 analyses?

Get the help of the recognized authorities—the Timken Company metallurgists. Through 20 years of development and testing of 23 different analyses to solve specific problems of heat, pressure, corrosion and oxidation, they've gained the experience needed to choose the best steel for *your* job. And you're assured uniform, high quality steel in every tube because of complete, rigid controls—from melting to final tube inspection—practiced in our mills.

Let our "RSQ"—Research, Supply, Quality—solve your tube problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, O. Cable address: "TIMROSCO".

This month we report on: **2% CR.-MO.**

Has intermediate corrosion resistance in combination with good creep strength and fair resistance to oxidation. For use at temperatures up to 1200°F. in cracking coils, reforming units, heat exchangers, vapor line and hot oil piping, and return bend forgings for oil heaters.

23 TIMKEN STEELS FOR HIGH TEMPERATURE SERVICE

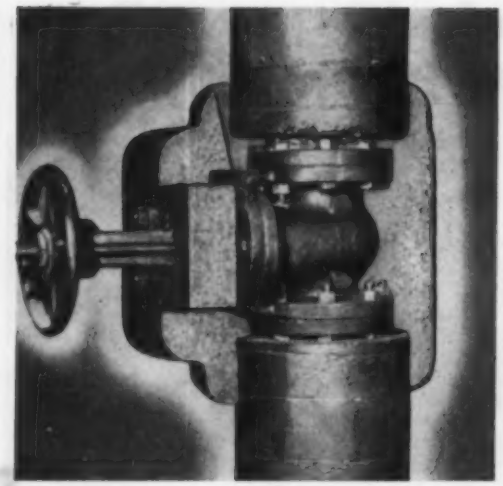
Carbon	Sicromo 2	Sicromo 5S	16-13-3*
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	25-20*
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-12*
Silmo	Sicromo 3	Sicromo 9M	35-15*
DM	4-6% Cr.-Mo.	18-8 Stainless	16-25-6*
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	

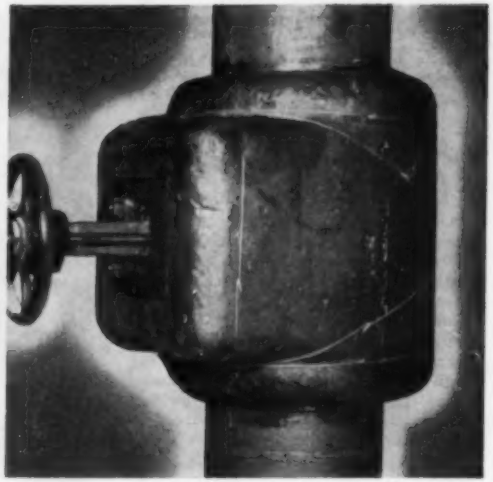
**Available as seamless tubing on an experimental basis only.*

20 years of extensive testing and research have made the Timken Company the leading authority on high temperature tubing. Photo shows Charpy impact tests.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.





We have been asked . . .

"Several weeks ago we installed two new cold lines," writes a plant maintenance superintendent. "I noticed a considerable rise in the cost of wrap-around insulation for these lines and wondered how the cost of cork might have compared. We've avoided the use of cork cold line insulation in the past because we thought it was an expensive proposition. Were we wrong?"

In answering this question we stressed the fact that today a large part of the cost of insulating cold lines involves the time required to do the job. On this one point alone, cork turns out to be a real dollar-saver. Here's why:

Armstrong's Cork Covering is a molded covering, made to accurate dimensions to fit all sizes of pipes. That means it goes on fast. It is light in weight, structurally strong, easy to handle.

The speed with which cork goes on is particularly noticeable and advantageous when valves and other fittings are being insulated.

"Is cork covering expensive to install?"

Armstrong's molded cork covers can be completely installed in less than half the time that a good wrapping job will take.

Because it saves so much time in application, the use of cork covering usually reduces the over-all cost of most cold line insulation jobs.

Cork has other features that save you money, too. It has high natural moisture resistance, which means longer service life and exceptionally low maintenance costs. Original high insulation efficiency is maintained, preventing the gradual rise in refrigeration costs that occurs when inferior pipe covering materials deteriorate and let heat through.

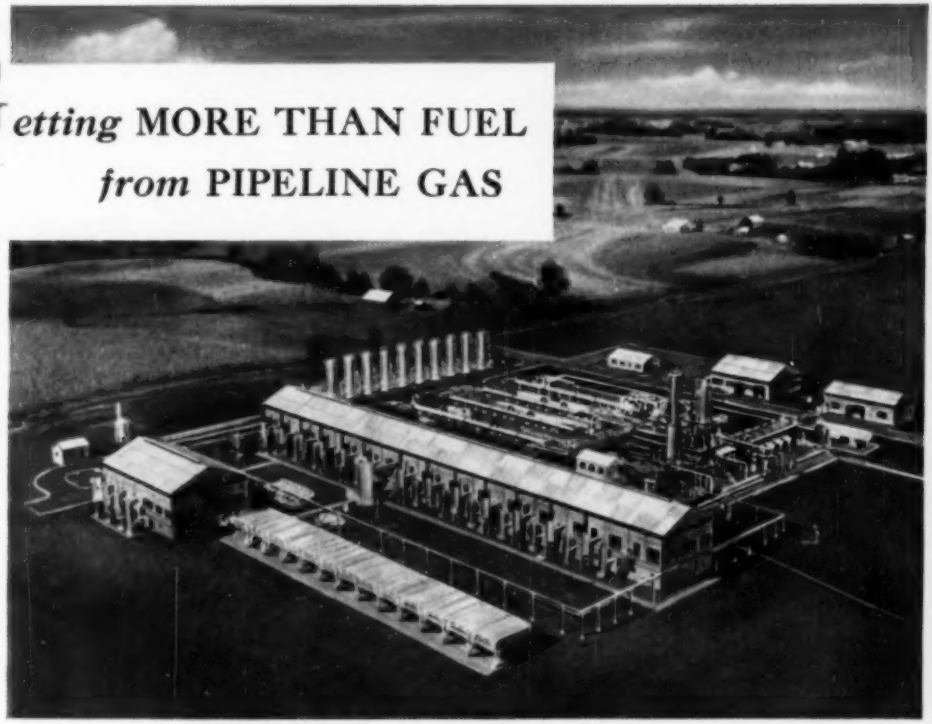
SEND US YOUR QUESTIONS: If you have any questions on the use of insulating materials or the construction of low-temperature facilities, please do not hesitate to write to us. We'll see that you get a practical answer. Just address a letter or post card to Armstrong Cork Company, 3312 Concord Street, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

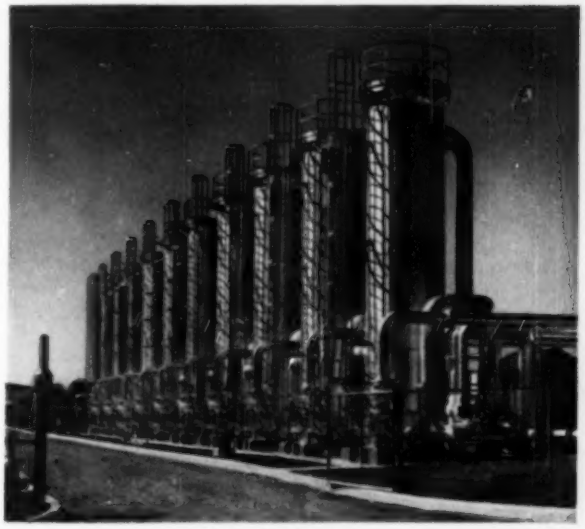
Getting MORE THAN FUEL *from* PIPELINE GAS



Hydrocarbon Extraction Plant, Tennessee Gas Transmission Company

This plant of the Tennessee Gas Transmission Company at Gabe, Kentucky, is the first of its kind to be constructed adjacent to a major natural gas transmission line, for the further extraction of bottled gas and aviation and motor gasoline components from "dry" pipe line gas.

Stone & Webster Engineering Corporation made a report and appraisal of the economics, feasibility and best location for the project and was employed for the design and construction of the plant.



Battery of Dehydrators

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

A Dramatic Example of BARRETT'S EXPANSION

As defense production has been stepped up, the demand for Barrett* chemicals has grown tremendously.

Among the Barrett products eagerly sought is phthalic anhydride, vital to the production of alkyd resins, phthalate ester plasticizers, and many other important materials.

To meet this great demand, Barrett has taken two decisive steps that will substantially raise the output of phthalic anhydride.

First, the capacities of Barrett's Philadelphia and Ironton plants already have been increased. Second, Barrett is well under way in its plans to build two new plants in Chicago and Philadelphia. The one in Philadelphia alone will increase the production of phthalic anhydride by 36,000,000 pounds each year!

For defense and for civilian production . . . Barrett is expanding to help keep America strong!

* Reg. U. S. Pat. Off.

Barrett

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

LEADING MANUFACTURERS CREDIT ON BARRETT AS THE LARGEST PRODUCER OF PHTHALIC ANHYDRIDE

ENJAY

*Trade-Mark

A pointer for products

sells an extensive line of oxygenated solvents and chemicals

Every day more industries are buying Enjay chemicals. Industrial users know that the solvents and chemicals sold under the ENJAY* Oval Trade-mark are famous for high-quality and dependability.

EXPERIENCED

RELIABLE

DIVERSIFIED

ENJAY markets this wide range of industrial chemicals:

Petrohol 91 (Isopropyl Alcohol)	Methyl Ethyl Ketone	Aromatic Tars
Petrohol 95 (Isopropyl Alcohol)	Ethyl Ether	Paratone
Petrohol 99 (Isopropyl Alcohol)	Isopropyl Ether	Parapoid
Secondary Butyl Alcohol	Diisobutylene	Paratac
Isooctyl Alcohol	Polypropylenes	Paranox
Isopropyl Acetate	Butadiene	Paraflow
Secondary Butyl Acetate	Isoprene	Vistanex
Acetone	Dicyclopentadiene	Naphthenic Acids

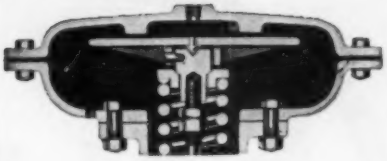
ENJAY products are marketed in bulk or in quantities to fit your requirements.

ENJAY COMPANY, INC.
15 W. 51st St., New York 19, N. Y.

* COMPARE

THIS FEATURE

OF THE HONEYWELL SERIES "700" VALVE



Pre-Molded Neoprene Diaphragm, with rolling action. Eliminates wrinkling or buckling . . . responds to slightest change in signal air pressure . . . withstands excessive pressures . . . available with cotton or nylon reinforcement . . . permits use of gas as actuating medium.

Duplex Upper Stem Guide

Packless Bellows Seal

Safety Stem Lubricator

One-Piece Bonnet

Wide Variety of Discs

Reversibility in the Field

* Compare the diaphragm assembly of this valve with that of any other wide band proportional type. Look at it closely . . . study it feature by feature.

Then check the other features of the valve . . . the Duplex Stem Guide, the One-Piece Bonnet, the Packless Bellows Seal, the Safety Stem Lubricator, the wide variety of discs, the easy reversibility in the field from direct to reverse acting, or vice versa.

Your comparison will prove that the Honeywell Series 700 has *all* the features you look for in a fine valve.

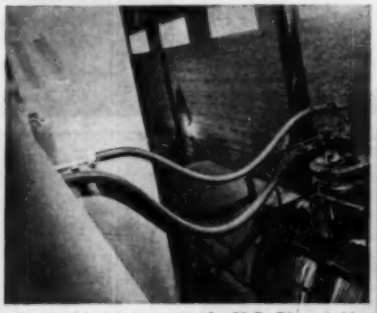
It's available in a wide range of styles and sizes. For detailed information, write for a copy of Bulletin 750 or call in your local Honeywell engineer . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1904 Windrim Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS **Honeywell**

Valve Products

What's U. S. Rubber doing to aid sewage treatment?



Ferric chloride is carried by U.S. Giant Acid Hose from tank cars to large acid storage tanks. The air hose throughout the plant is U.S. Brand.

These large storage tanks are protected by U.S. Permobond Rubber Lining especially compounded to resist corrosive action of ferric chloride solutions. Size of the tanks made it necessary to rubber line and vulcanize them in the field. Lining runs over the tops of tanks and extends down the outside 18 inches. See arrow.

In a large midwestern sewage plant, the acid storage tanks, pipes and fittings have U.S. Rubber linings. Conveyor belts, air and acid hose likewise are of U.S. Rubber manufacture. And the filters are equipped with Uscolite plastic piping and fittings developed by "U.S." engineers. All the above mentioned products are resistant to the highly corrosive action of ferric chloride, used in sewage treatment.

This installation – involving so many different products – affords convincing evidence of the scope and versatility of U.S. Rubber engineering skill.

22 U.S. Rubber conveyor belts run below the floor, collecting sludge as it drops from the filters, and carrying it to the driers.

PRODUCTS OF U.S. RUBBER

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

MONSANTO
CHEMICALS — PLASTICS

MONSANTO DICYCLOHEXYLAMINE MAKES RUST-PREVENTING PAPER POSSIBLE

Manufacturers of ferrous metal parts are saving time and money by packing their products with a new paper that prevents rust. The paper is coated by a patented process that employs dicyclohexylamine, phosphoric acid 75% and other materials. Monsanto is the only American manufacturer of dicyclohexylamine.

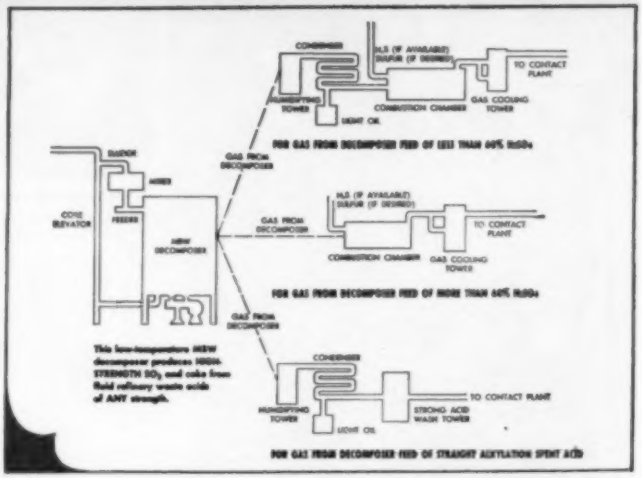
Use of the chemically treated paper makes it unnecessary to slush parts with grease. Packing does not need to be tight enough to seal out moisture and other corrosion factors.

As much as 60% of packaging time is saved. Shipping costs are lowered because lighter containers can be used. Parts reach their destinations ready for use, saving time formerly used for cleaning. Flammable solvents used to clean ordinary rust preventatives from metal parts are no longer needed, thus eliminating a dangerous fire hazard.

The new packaging method, currently being used for products ranging from watch parts to automotive parts, gives positive protection as long as the inhibiting chemical is present in the package. Protection for at least five years has been observed in outdoor exposure.

The protection is effective in climates from the Arctic to the tropics . . . even in salt air. It has been thoroughly tested by a number of leading manufacturers.

If you manufacture equipment employing ferrous metals, this new paper can perform a valuable service for you. We will be glad to give you names of manufacturers of this new packaging material. Just check the coupon and mail it to us and we will reply promptly.



HOW TO MAKE WHITE SULFURIC ACID FROM REFINERY SLUDGE

Clean, white sulfuric acid, of any desired strength, can be made from oil refinery sludge or H_2S—or both together—with a Monsanto-Ross-Wilde sludge recovery unit. (Various operations of the unit are diagrammed above.) The Monsanto-Ross-Wilde unit may operate with existing contact sulfuric acid plants, or Monsanto will design sludge recovery and sulfuric acid units as a single project.

In addition to sulfuric acid, these units recover oil from some types of sludge. The recovered oil can be refined into salable products.

Refineries can improve their community relations by eliminating stream and atmospheric pollution. Urgently needed tank cars, now used to carry away sludge and to return reclaimed acid, will be available for other purposes once the Monsanto-Ross-Wilde sludge recovery unit is in operation.

Because of the present sulfur shortage and the growing use of sulfuric acid, a Monsanto-Ross-Wilde sludge recovery unit should be a sound investment for the present and future.

If you have a refinery sludge problem, mail the coupon for a booklet on the Monsanto-Ross-Wilde process.

SANTODEX GIVES VISCOSITY INDEX OF 140 OR HIGHER

Expanded production of Santodex,* Monsanto's viscosity index improver, makes the product available in greater quantities to users and obtainable to many we could not serve in the past.

Developed primarily for improving the viscosity index of motor oils, Monsanto Santodex makes possible indices of 140 or more.

Santodex is an economical viscosity index improver that offers the following advantages:

1. Improves ease of engine starting at low temperatures.
2. Reduces engine oil consumption.
3. Improves piston ring seal.
4. Reduces number of viscosity grades of motor oils necessary to meet field requirements.
5. Provides more effective use of lighter viscosity lubricating oil stocks.
6. Meets specifications containing high viscosity index requirements.

Mail the coupon for a free copy of Monsanto Technical Bulletin No. O-48, "Santodex, Viscosity Index Improver." The publication contains 12 pages of valuable information.

Research Chemists' Corner

You may find something new here

You may find opportunities for new product development and improvement of your present products in these five special Monsanto Chemicals. Look over their properties and, if you see research possibilities in them, mail the coupon or contact the nearest Monsanto Sales Office for samples. Samples of any or all of them will be sent to qualified chemists without cost or obligation. If you find uses for them you can count on these chemicals to be available in commercial quantities.

PHENYLACETONITRILE

STRUCTURAL FORMULA:

APPEARANCE:	Clear water-white liquid
ASSAY:	97.0% Min.
CRYSTALLIZING POINT:	Minus 23.0° C. Min.
BOILING RANGE:	
First drop	232.0° C. Min.
1–96 cc.	3.0° C. Max.
100%	6.0° C. Max.
Dry point	238.0° C. Max.

PHENYLACETAMIDE

STRUCTURAL FORMULA:

APPEARANCE:	Fine white crystals
ASSAY:	98.5% Min.
MELTING POINT:	158.0 C. Min. to start
ODOR:	Characteristic

beta-PHENYLETHYLAMINE

STRUCTURAL FORMULA:

APPEARANCE:	Colorless to slightly yellow liquid
MELTING POINT ASSAY:	99.0% Min.
SP. GR.:	at 15°/15° C. 0.963–0.967

POTASSIUM PHENYLACETATE

(44% SOLUTION)

STRUCTURAL FORMULA:

APPEARANCE:	Colorless to slightly yellow liquid
ASSAY:	44% Min.
pH:	7.0 Min. 8.0 Max.
HEAVY METALS:	30 ppm Max.
REFRACTIVE:	Refractive index at 25° C. 1.4750–1.4820
ODOR:	Characteristic

PHENYLACETIC ACID

STRUCTURAL FORMULA:

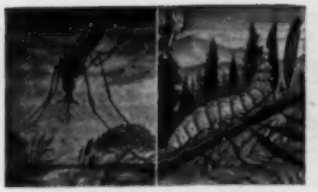
APPEARANCE:	White crystals
ASSAY:	99.0% Min.
ODOR:	Characteristic
MOISTURE (H_2O):	0.50% Max.
MELTING POINT:	76.0° C. Min.

SANTOPHEN 1 KILLS GERMS AND STOPS FUNGI

Monsanto Santophen* 1 (ortho-Benzyl-para-chlorophenol, technical) is a versatile germicide, toxic to both bacteria and fungi.

Santophen 1 is used extensively in liquid soaps and cleaners . . . in rug shampoos . . . in surgical soaps . . . in cleaners for restrooms and locker rooms . . . in formulations for use in hospitals on floors, walls, linens and surgical instruments.

For further information on Santophen 1, mail the coupon for a copy of Monsanto Technical Bulletin No. O-51, "Santophen 1 for use in disinfectants."



DDT CONTINUES TO SCORE VICTORIES

DDT has been victorious in fighting insects in two widely separated fields. Both are extensive operations against pests which have been problems for years.

Spruce budworm, attacking forests in the Pacific Northwest, has been sprayed with DDT in one of the biggest projects of its kind in America. Spraying from the air, pest fighters have covered around 2,141,000 acres of timber.

Malaria-carrying mosquitoes have been controlled by the use of DDT in homes and in outdoor toilets. New infestation due to floods and, in some measure, to the return of military personnel carrying the disease, has made increased vigilance necessary.

A pest-control program recently announced, using DDT and other insecticides, saved $24,000,000 for the Army. The entire cost of the program, including personnel, equipment and insecticides, was only $1,300,000.

For information on DDT and its uses, contact the nearest Monsanto Sales Office or mail the coupon for literature.

• • • • • • • •

MONSANTO CHEMICAL COMPANY, 1700 S. Second Street, St. Louis 4, Missouri. District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

*Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS — PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

SEND INFORMATION:
- ☐ Dicyclohexylamine.
- ☐ Makers of rust-preventing paper.

SEND LITERATURE:
- ☐ Monsanto-Ross-Wilde process.
- ☐ Bulletin O-51 (Santophen 1).
- ☐ Bulletin O-48 (Santoflex). ☐ DDT.

SEND SAMPLES:
- ☐ Phenylacetonitrile. ☐ Phenylacetamide.
- ☐ beta-Phenylethylamine.
- ☐ Potassium Phenylacetate.
- ☐ Phenylacetic Acid.

MONSANTO CHEMICAL COMPANY
1700 South Second Street, St. Louis 4, Missouri
Please send, without cost or obligation, information, samples or literature as indicated at the left.

Name.....Title.....

Company.....

Street.....

City.....Zone.....State.....

HIEROGLYPHICS ··· *with a modern meaning*

The workman of ancient Egypt knew the symbols of his trade. They helped him fashion stone and metal, wood and cloth, into the goods and structures which best served his era. . . . The needs of our modern industrial civilization are different. Visitors to Sun Ship's mighty shops see in the making the intricate steel fabric of petroleum refineries and chemical plants . . . massive bubble towers, pressure vessels, condensers, cracking cases, and a vast array of special machinery and equipment for many industries.

But even a visitor from the days of Egypt's Pharaohs would recognize two familiar facts — that strange modern "hieroglyphics" guide precise assembly of today's steel behemoths . . . and that Sun Ship workers are masters in their knowledge of the symbols and crafts of their trades. . . . The many modern industries served by Sun know these facts, too.

Illustration at top, reproduced from "The History of All Nations," shows ancient Egyptian shipbuilding as depicted on the tomb of Ti, at Sakkara. In contrast is the 55' regenerator being built by Sun.

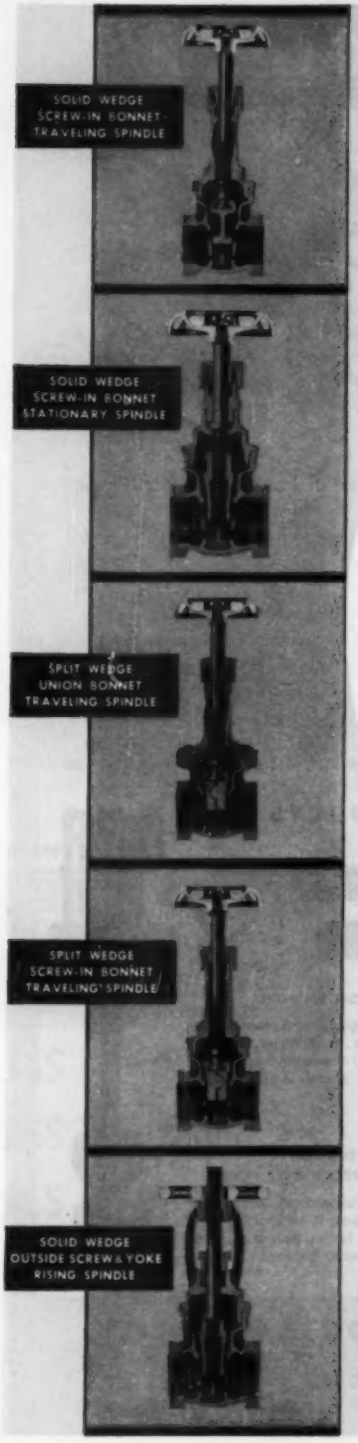
Sun

SHIPBUILDING & DRY DOCK COMPANY

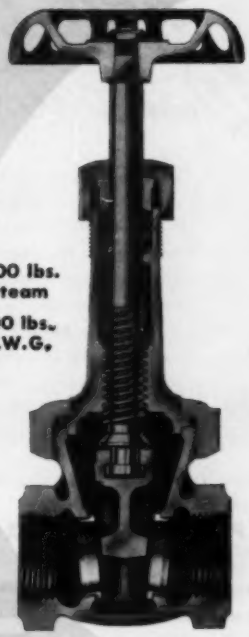
SINCE 1916

ON THE DELAWARE • CHESTER, PA.

25 BROADWAY • NEW YORK CITY



Specify JENKINS for your Best Buy in Bronze Gates



200 lbs. Steam

400 lbs. O.W.G.

JENKINS FIG. 270-U

Solid Bronze Wedge

and FIG. 270-UN

Nickel Alloy Wedge

Traveling Spindle — Union Bonnet

BRONZE GATES

Monel and Bronze Seating Combination Adds Years of Extra Service Life

In Fig. 270-U, a high quality bronze wedge seats against MONEL rings expanded in the body. With this sensible design, the wear affects only the most accessible part—the bronze wedge—which can be easily replaced by slipping a new one on the stem when necessary. Records in every type of service prove it an excellent combination for lasting economy.

Fig. 270-UN, with a nickel alloy wedge, is recommended for exceptionally severe conditions of rapid wear and corrosion.

The Gates For Your Toughest Services

Made in sizes from ¼" to 2", Fig. 270-U or Fig. 270-UN will provide unequalled economy in any 200 lb. steam, 400 lb. O.W.G. service. Compare performance, especially where conditions are most destructive to valves, as in oil refineries, dye houses, chemical, rubber, and food plants. You'll find there are no other valves like them.

Whatever your need in Bronze Gates, you'll find the right valve for the service in Jenkins complete line. Thirty-five different patterns are available for steam pressures up to 300 lbs., O.W.G. pressures up to 600 lbs. All are built to Jenkins unvarying high standard which makes them the longest-lasting, lowest-upkeep valves that money can buy. Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors.

WRITE FOR THIS FOLDER
Form 181-B It describes the Fig. 270-U and other popular Jenkins Bronze Gates or, ask your Jenkins Distributor.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

Jenkins Bros.

PENBERTHY Liquid Level Gages

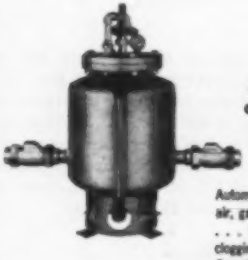
YOU CAN *Remove and Replace Without Shutdown*

Union connections between the gage and the valves permit removal of gage for repairs without shutting down the equipment. Just close the valves, uncouple the unions and remove the gage. The convenience of this is obvious. When glasses have to be replaced or repairs made, it is not necessary to work in an awkward position or to shut down. Another advantage: a gage needing repairs can be replaced immediately by a spare and the repairs made at leisure. There are many other reasons for the superiority of Penberthy Liquid Level Gages; ask for Catalog 35.

OTHER PENBERTHY PRODUCTS

PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction —liquid chamber machined from solid block of metal. Ask for Catalog 35.



PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.

PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.

PENBERTHY EXPLOSION-PROOF SUMP PUMPS

Motor and switch totally enclosed. Underwriter approved for Class I, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.

4672

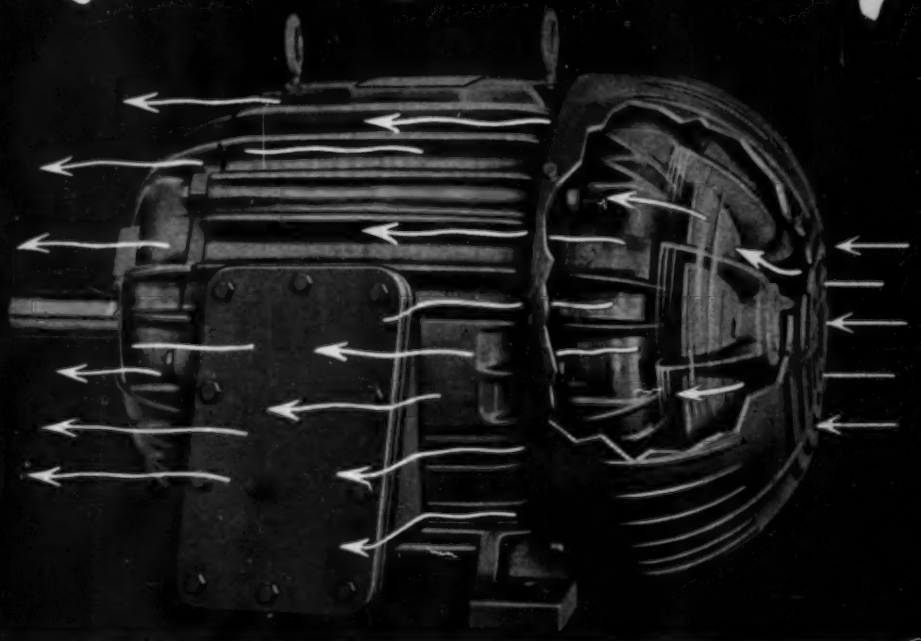
PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

DETROIT 2, MICHIGAN

Established 1886 — *Canadian Plant, Windsor, Ontario*

STAYS Cool - STAYS Clean - STAYS Safe!



THE ELLIOTT CROCKER-WHEELER

Approved-

Underwriters' Laboratories, Inc.
INSPECTED
ELECTRIC MOTOR FOR HAZARDOUS LOCATION
CLASS ■ GROUP ■ No ■

CLASS I - GROUP D

CLASS II - GROUP F

CLASS III - GROUP G

EXPLOSION-PROOF *Sealedpower* MOTOR

■ TEN YEARS AGO the C-W "Sealedpower" motor, with its unique cooling and self-cleaning system, made its bow to American industry. Its immediate and continued popularity has put thousands into successful and satisfactory service.

Now designed with approved explosion-proof enclosure, adding that advantage to the exceptional coolness and cleanliness due to the fan-driven air blast directed along the radial fins, that sweeps away heat, and will not allow dirt or dust to settle.

Here is the ideal motor for refinery and natural gasoline plant drives. Write for the Explosion-proof Sealedpower Bulletin.

1901 HALF CENTURY OF POWER PROGRESS 1951

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PLANTS AT: JEANNETTE, PA. • RIDGWAY, PA.
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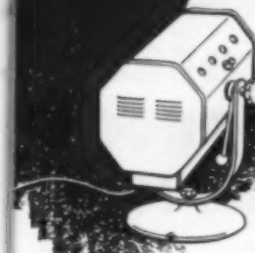
ELLIOTT *Approved* SERVICE SHOPS Cover the Country

CW-38

You're a step ahead with **ELLIOTT**

With the spotlight on OUTPUT and COSTS,



the right refractories in the right places mean INCREASED PRODUCTION —GREATER ECONOMY

In chemical processing operations involving high temperatures, smooth economical production frequently depends upon the use of refractories which render maximum service with minimum maintenance.

Harbison-Walker offers a complete line of refractories for chemical processing furnaces, kilns, ovens, boiler settings and other equipment. There are classes and types for each set of conditions. Regardless of the type of fuel, method of firing, temperature, kind of fluxes and gases involved, amount of abrasion and other factors, you can select Harbison-Walker refractories having the properties needed for your particular service conditions.

Harbison-Walker engineering service can help you select the refractory that will be most beneficial in keeping costs low and production high.

Harbison-Walker Refractories Company

AND SUBSIDIARIES

World's Largest Producer of Refractories

General Offices.....PITTSBURGH 22, PENNSYLVANIA

Don't let "BIG ENOUGH for TODAY" become tomorrow's bottleneck

You're going to like the smoother, faster pace at which production moves in areas kept moisture-free with Lectrodryers. Experience shows that you'll soon want to add more people and more equipment for processing more materials. Plan plenty of space-DRYing capacity, therefore, so that "big-enough-for-today" doesn't become tomorrow's bottleneck.

Moisture that leaks through walls, doors, and windows can be held down by air locks and insulation. But added workers, machines, and materials are sources of additional moisture; increase them and you increase the DRYing load. Change to a more toxic product and you must admit more make-up air than is now contemplated.

Lectrodryers are generously designed for dependable, low-cost service. And when a Lectrodryer engineer names the size you need, you're assured it will do the job. Experience has shown, however, that it's wise to go larger than your minimum requirements.

Tell us as much as you can about your space-DRYing needs. Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

Processes proceed in "winter weather" the year around with these Lectrodryers on the job.

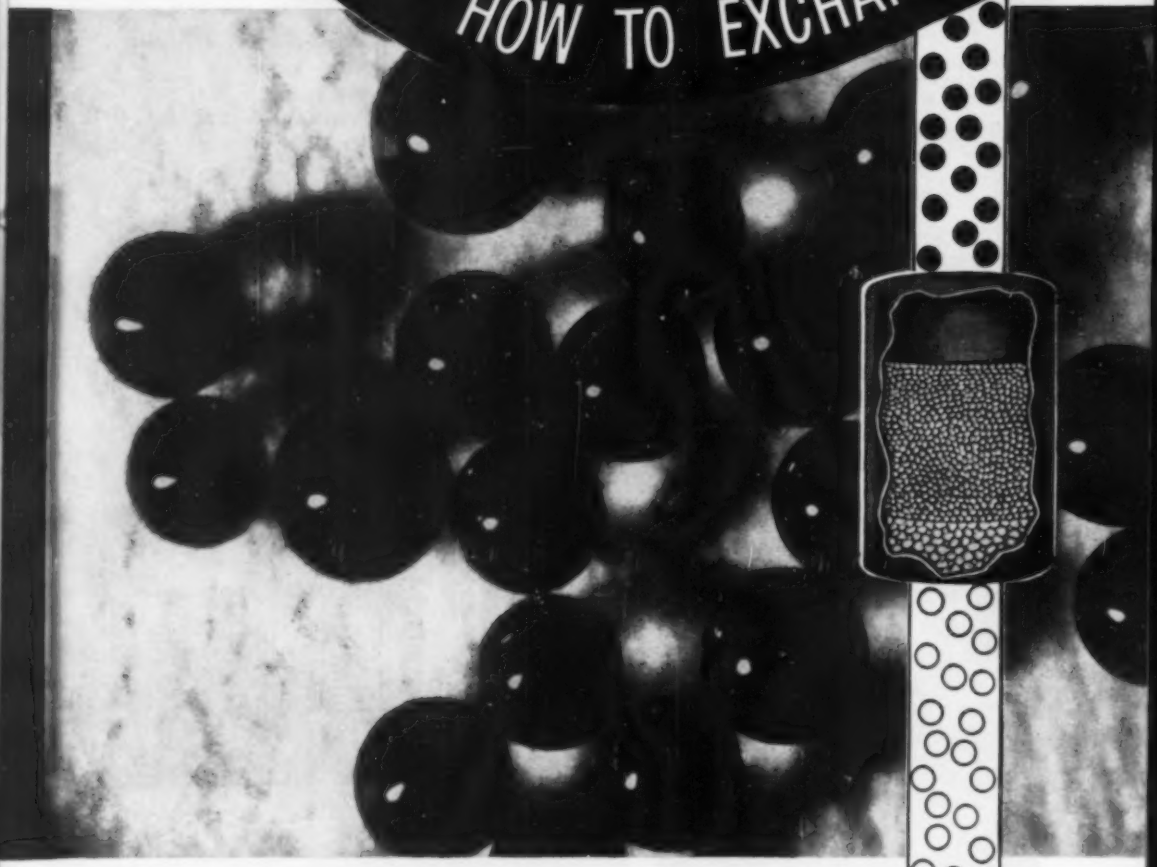
In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sydney.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

*REGISTERED TRADEMARK U. S. PAT. OFF.

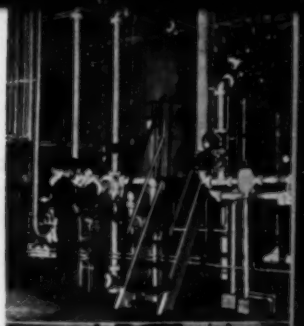
HOW TO EXCHANGE IONS



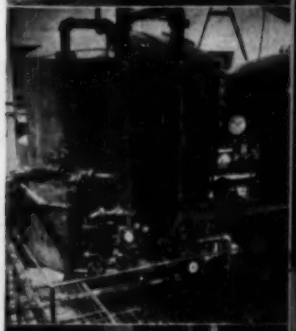
PHOTOMICROGRAPH OF PERMUTIT Q,
A RESIN TYPE ION EXCHANGER

ION EXCHANGE AND WATER CONDITIONING

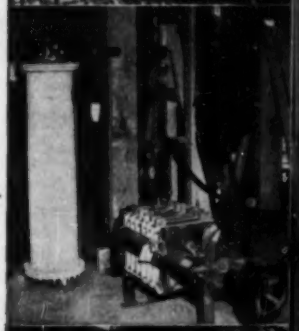
. . FOR DOLLARS



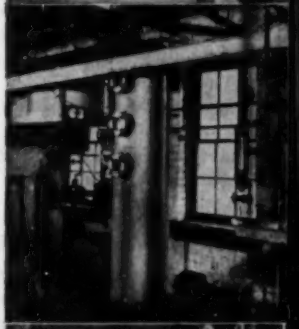
Polyhydric Alcohol Demineralizing Plant in an Eastern chemical center, improving product quality



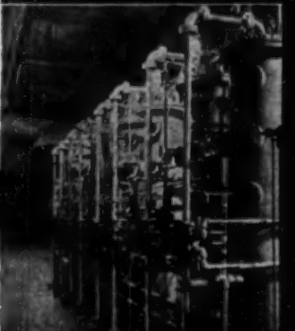
Citrus Juice Demineralizing Units, recovering sugar syrup from waste material



Alkaloid Recovery Cation Exchange Unit, concentrating scopolamine in a Texas plant



De-acidite Unit in a chemical company, removing residual sulfates from amino acid



Sugar Demineralizing Pilot Plant eight cation—anion exchanger units, improving yield of dextrose from cornstarch

For example, many formaldehyde producers are improving the quality of their product by use of ion exchange. The formaldehyde is passed through an anion exchanger which removes essentially all of the formic acid, thus making it more valuable in uses requiring low acidity.

Or, as steel fabricators have done, replace obnoxious sulfuric acid pickling with phosphoric acid pickling—made feasible at low cost by regeneration of the bath with a Permutit ion exchange resin—and actually realize *savings* with the superior pickling and coating process.

Again, as in the case of a textile fibre producer, recover scarce and valuable copper from waste waters—thanks to Permutit's ion exchangers!

Further . . . but there is literally no end to the ways ion exchangers can save money, *make* money. A few installations are described and illustrated at right.

For more complete information, write to The Permutit Company, Dept. CE-12, 330 West 42nd Street, New York 18, New York, or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

PERMUTIT®

HEADQUARTERS FOR NEARLY 40 YEARS

When they organized their salvage drive

DIAMOND ALKALI CHEMICALS

DIAMOND ALKALI more than doubled scrap shipments

WHY NOT GET CASH for your hidden scrap?

What firms like Diamond Alkali have done, your plant can do. All of us must dig deeper. As you know, it takes *one ton* of your old, obsolete and worn-out machinery, tools, dies, pipe and fittings, rails, chain, jigs, fixtures, rusted out tanks and boilers, to make *two tons* of new steel. The nation needs that steel, now. You need it. So, appoint a scrap collection team. Study all locations which are potential sources for scrap.

Sell it to your SCRAP DEALER

The procedure of returning scrap to the mills is far simpler than even the most elementary salvage program. Scrap commands an excellent price. So, turn it up and turn it over . . . to your scrap dealer for cash.

THIS 4-POINT PROGRAM GOT RESULTS:

● The Painesville, Ohio, plant of Diamond Alkali Company daily turns out hundreds of tons of alkali chemicals and allied products. When scrap metal shortages threatened, this producer put into effect a program which is channeling hundreds of tons of iron and steel scrap back to the mills.

Their successful program is based on planned *collections from four sources:*

1 **The continuous supply from plant maintenance, as machinists, pipefitters, ironworkers, and other craftsmen produce odds and ends in the regular performance of their work. This might be termed the "waste" from normal plant operations.**

2 **Scrap salvaged from the routine replacement of specialized equipment and materials of vital producing components.**

3 **Scrap salvaged as construction of new facilities, rehabilitation, and modernization goes on while the plant mobilizes to meet the need for greater alkali production.**

4 **Scrap salvaged from discontinued operations and from structures no longer used.**

Who did it? Naturally, many employees cooperated. The plant general manager designated the works engineer to head up the scrap collection program. He, in turn, appointed two plant engineering staff men to study locations which might be potential sources. Plant layout was studied to determine what could be scrapped, what could not. This "in-plant" team worked with the salvage department, already organized to handle routine scrap. An outside salvage firm was retained to dismantle an old bridge crane, other items. No possible supply of scrap metal has been overlooked.

Results! By midyear, more scrap metal had come from the plant than ordinarily is shipped in a year's time. In one four week period alone, twelve full cars of scrap were started back to the hungry steel furnaces.

REPUBLIC STEEL

REPUBLIC STEEL CORPORATION

General Offices • Cleveland 1, Ohio

better measurement and control of

HUMIDITY

Ever since the origination of accurate humidity control by Foxboro, this Company has been foremost in the development of instrumentation for absolute humidity, relative humidity, moisture content and dew point . . . whether in gas, air, bulk materials or moving sheet stock. The high quality standards and complete diversity of Foxboro Instruments . . . backed by Foxboro's broad experience . . . offer you unmatched facilities for obtaining the most efficient system for your operation.

INDICATORS • RECORDERS • CONTROLLERS

hygroscopic, wet-and-dry bulb, capacitance, plus the unique "Dewcel" system for continuous recording and control of either absolute humidity or dew point.

TRANSMISSION SYSTEMS • CONTROLLED VALVES

FOXBORO

Reg. U. S. Pat. Off.

... specialists in the measurement and control ... Flow, liquid level, humidity . . .

... COMPANY, FOXBORO, MASSACHUSETTS, U. S. A.

GUARD YOUR PRODUCTION AGAINST the Hazard of SPLASHING LIQUIDS

WITH

Century SPLASH PROOF MOTORS

Century 7½ HP Type RS Single Phase Repulsion Start Induction Brush Lifting Splash Proof Motor.

1 to 7½ HP Direct Current Splash Proof Motor.

150 to 400 HP Type SC Squirrel Cage Induction 3 Phase Splash Proof Motors.

30 to 100 HP Type SR Slip Ring Induction 3 Phase Splash Proof Motors.

1 to 125 HP Type SC Squirrel Cage Induction 3 Phase Splash Proof Motors.

3 to 25 HP Type SR Slip Ring Induction 3 Phase Splash Proof Motors.

1 to 20 HP Type CS Capacitor Start Induction Single Phase Splash Proof Motor.

Keep the vital parts of your motors dry —even when the full force of a hose is turned directly on them. Century Splash Proof motors eliminate production losses due to dripping or splashing liquids or falling solids. They also protect against rain, snow, sleet or hail on outdoor installations.

Century Splash Proof motors are available in a wide range of types and sizes for all popular applications. Other types and ratings are available to meet your electric power requirements. You can specify Century motors with confidence.

Century motors are built in sizes ⅙ to 400 horsepower.

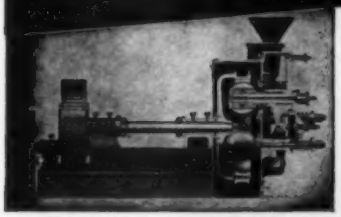
697

Century Motors

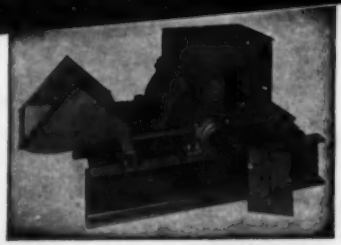
CENTURY ELECTRIC COMPANY, 1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Step-up Production Lower Preparation Costs with STURTEVANT EQUIPMENT



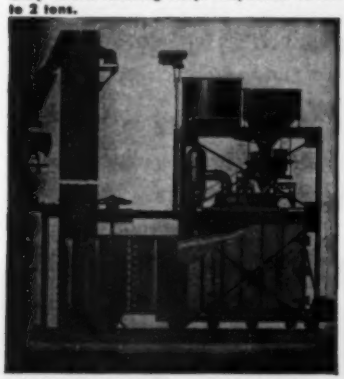
RING ROLL MILL — for medium and fine reduction of hard or soft materials (10 to 200 mesh). Open-door accessibility for easy cleaning. Available in many sizes and capacities.



TAILINGS ROTARY PULVERIZER — increases output of fertilizer tailings . . . will not clog . . . leaves no daily accumulation of unground pellets. Capacities up to 25 tons per hour.

DRY BATCH MIXERS — 4-way mixing action mixes two or more ingredients into an inseparable, homogeneous mass. Open door accessibility makes cleaning easy. Capacities ¼ ton to 2 tons.

MOTO-VIBRO SCREENS — screen everything screenable. Open and closed models with or without feeders. Many types and sizes . . . screens from ½" to 60 mesh.



DEN AND EXCAVATOR — speeds processing of superphosphates. Easily operated by two men . . . produces 16 to 40 tons per batch and up to 480 tons per day of superior fertilizer free from lumps.

AIR SEPARATOR — for finest separation of materials. Capacities from ¼ ton to 50 tons per hour in fineness of 40 to 325 mesh and finer. Increases production of fines, cuts power consumption costs.

Sturtevant Processing Equipment . . . Grinders, mixers, separators, screens, etc. . . . can help you *reduce* today's high manufacturing costs by increasing both machine and operator output, lowering production costs, assuring high quality products.

Records in all types of industries — chemical, plastics, ceramics, cement, food, construction — prove that this equipment works dependably day in, day out with little, if any, maintenance.

Used individually or linked together in proper sequence, they do the job faster and easier than other types . . . handle a larger variety of work.

It will pay you to investigate Sturtevant Processing Equipment for your plant. There is a size and type of machine that will meet your requirements. Write for information.

STURTEVANT MILL COMPANY

100 CLAYTON STREET
BOSTON 22, MASSACHUSETTS

Designers and Manufacturers of:

CRUSHERS • GRINDERS • SEPARATORS
CONVEYORS • MECHANICAL DENS
and EXCAVATORS • ELEVATORS
MIXERS

QO CHEMICALS

THE QUAKER OATS COMPANY

Announces

the completion of its NEW
QO-Furfural Plant at Omaha, Nebraska

The Quaker Oats Company's Omaha Chemical Plant is now producing the industrially important chemical, QO-Furfural. This chemical is made from raw materials such as corn cobs and oat hulls which are replaceable yearly.

The first QO-Furfural was produced at Cedar Rapids, Iowa 29 years ago. Now this versatile chemical is made not only at Cedar Rapids, but also at Memphis, Tennessee and Omaha, Nebraska.

QO-Furfural is used in refining lubricating oils, gas oil and catalytic recycle stock; extractive distillation of C_4 hydrocarbons; as a chemical intermediate in the production of nylon, furfuryl alcohol, tetrahydrofurfuryl alcohol and other chemical derivatives; as an aldehyde in resin manufacture and as a reactive solvent.

A request on your letterhead will bring you the Bulletin entitled "Current Uses of Furfural."

QO The Quaker Oats Company CHEMICALS DEPT.

335C THE MERCHANDISE MART
CHICAGO 54, ILLINOIS
EASTERN SALES OFFICE:
ROOM 535C, 120 WALL ST., NEW YORK 5, N. Y.

In San Francisco The Griffin Chemical Company • In the United Kingdom, Imperial Chemical Industries Ltd., Billingham, England • In Australia, Swift & Company, Pty., Ltd., Sydney • In Europe, Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S. A. 42, Rue Pasquier, Paris 8e, France
In Japan, F. Kanematsu & Company, Ltd., Tokyo

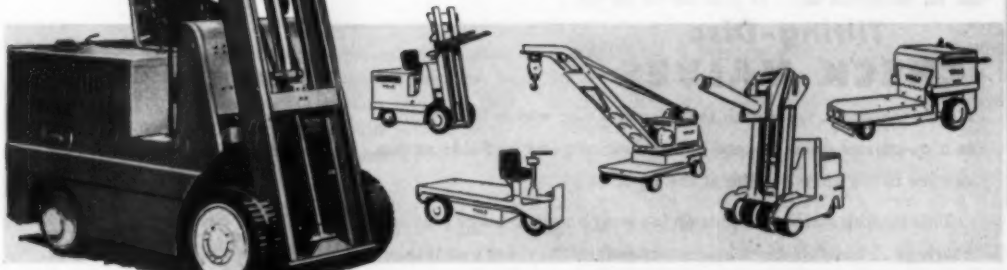
THE BIG 89% PROVES SUPERIORITY OF YALE ELECTRIC TRUCKS

89% of the Yale Electric Trucks sold today are bought by previous users . . . so satisfied with Yale performance and Yale economy that Yale is their choice again.

THESE USERS had ample opportunity to make every on-the-job test—to compare Yale Electric Trucks with any others—to get dollars-and-cents proof of how Yale saves man-hours, steps up production, speeds all materials handling jobs.

These users found Yale Electric Trucks pay for themselves faster...then go on giving many years of service... taking the toughest jobs right in stride.

If you're not already among the users of Yale Electric Trucks, be guided by the Big 89% and this proven record of satisfaction. Ask your Yale Representative to show you the actual performance records which persuade Yale users to buy Yale Electric Trucks again and again.



YALE & TOWNE

The Yale & Towne Manufacturing Co., Philadelphia 15, Pa.

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SEND THIS COUPON TODAY

The Yale & Towne Manufacturing Co., Dept. 4412
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I am interested in cutting my materials handling costs.

☐ Please have your local representative call on me.
☐ Please send me free detailed literature.

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In Canada write: The Yale & Towne Manufacturing Company, St. Catharines, Ontario

YALE GAS AND ELECTRIC INDUSTRIAL TRUCKS • YALE WORKSAVERS • YALE HAND TRUCKS • YALE HAND AND ELECTRIC HOISTS

prevents wear on seats of

CHAPMAN

Tilting-Disc

CHECK VALVES

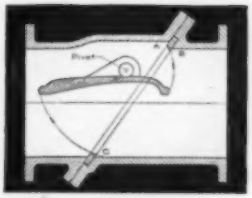
Here's the check valve with the balanced disc which is cushioned to a quick and quiet closure by the flow of gases or fluids as you can see in the cross-section at the right.

This smooth action prevents undue wear on seats, hinge pins and bearings . . . *and on your maintenance budget!* For there's no loosening of lines by vibration, no opened joints or ruptured pipes.

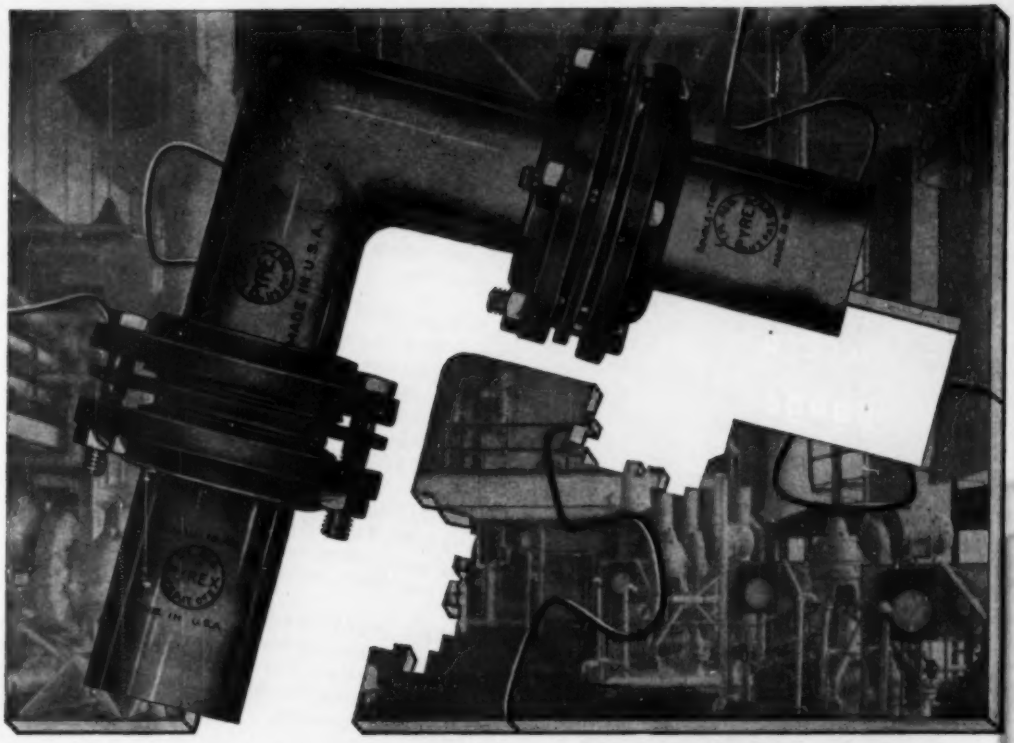
What's more, head losses are 65% to 80% less than conventional swing-type checks. Available in iron or steel in all standard pipe sizes. Get the complete story on this and other cost-cutting features of Chapman Tilting-Disc Check Valves, in the latest bulletin, No. 30. Send for your copy now.

THE CHAPMAN VALVE MFG. CO.

INDIAN ORCHARD, MASSACHUSETTS



Cross-section of the Chapman Tilting-Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.



Fit PYREX Brand GLASS PIPE

into your processing plans—*and save money!*

- **Stops pipeline corrosion**
- **Helps you spot trouble**
- **Costs less to install and maintain**

You can save thousands of dollars in chemical processing costs with PYREX Brand "Double-Tough" Glass Pipe. Its exceptional resistance to hot or cold acids, acid salts, mild alkalies and other corrosive liquids assures positive protection against pipe corrosion. Its high chemical stability also insures against product contamination.

Its visibility means fewer production shut downs and less product waste. You can spot sedimentation, crystallization or discoloration at a glance . . . correct it before real harm is done. Trouble can't hide behind glass.

PYREX brand glass pipe costs less right down the line. Its initial cost is reasonable. Its light weight and ease in plumbing keep installation costs low and its corrosion resistance makes replacement costs negligible.

Whenever you are faced with the problem of transferring a corrosive liquid or a product sensitive to contamination, it will pay you to look at PYREX brand glass pipe. It's safe, efficient, economical and *available* without priority through nation wide distributors. For complete information, mail the coupon below today.

CORNING GLASS WORKS

CORNING, NEW YORK

Corning means research in Glass

1851 • 100 YEARS OF MAKING GLASS BETTER AND MORE USEFUL • 1951

Technical Products Division: **Laboratory Glassware, Signalware, Glass Pipe, Gauge Glasses, Lightingware, Optical Glass, Glass Components**

CORNING GLASS WORKS, Dept. CE-12, Corning, N.Y.
Please send me your new Pyrex Brand "Double-Tough" Glass Pipe Catalog.

Name_____

Company_____

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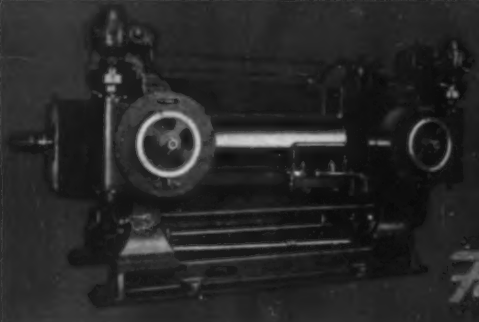
City_____ Zone____ State_____

For close temperature control and accurate gauge FARREL MILLS give you . . .
ROLLS which, in addition to being chamber-bored, are drilled longitudinally through the shell to provide more effective temperature control and greater uniformity of temperature across the entire roll face.
ROLL ADJUSTMENT that is motor-operated for quick and accurate control of gauge while the batch is on the mill, with vernier dial indicators to show roll movement in thousandths of an inch.
HOUSINGS made of high-strength Meehanite® metal, amply proportioned to withstand peak loads and shock.
JOURNAL BOXES made of Meehanite metal, full-bronze-lined, water-cooled and flood-lubricated for high-temperature operation.
MILL ROLL
ADJUSTING SCREW
HOUSING
JOURNAL BOX

Farrel-Birmingham is prepared to engineer a mill with any combination of design features and attachments necessary to fill your needs. Physical proportions, method of heating or cooling the rolls, gauge control, prevention of stock contamination — in fact, every detail of construction can be worked out to fit your requirements.

Furthermore, almost any "special" mill can be furnished from existing drawings and patterns — because, in a century of building processing machinery, Farrel-Birmingham has designed mills for almost every conceivable application. This means that, ordinarily, you can obtain the exact mill you require in a design that has been proved in service.

FB-69

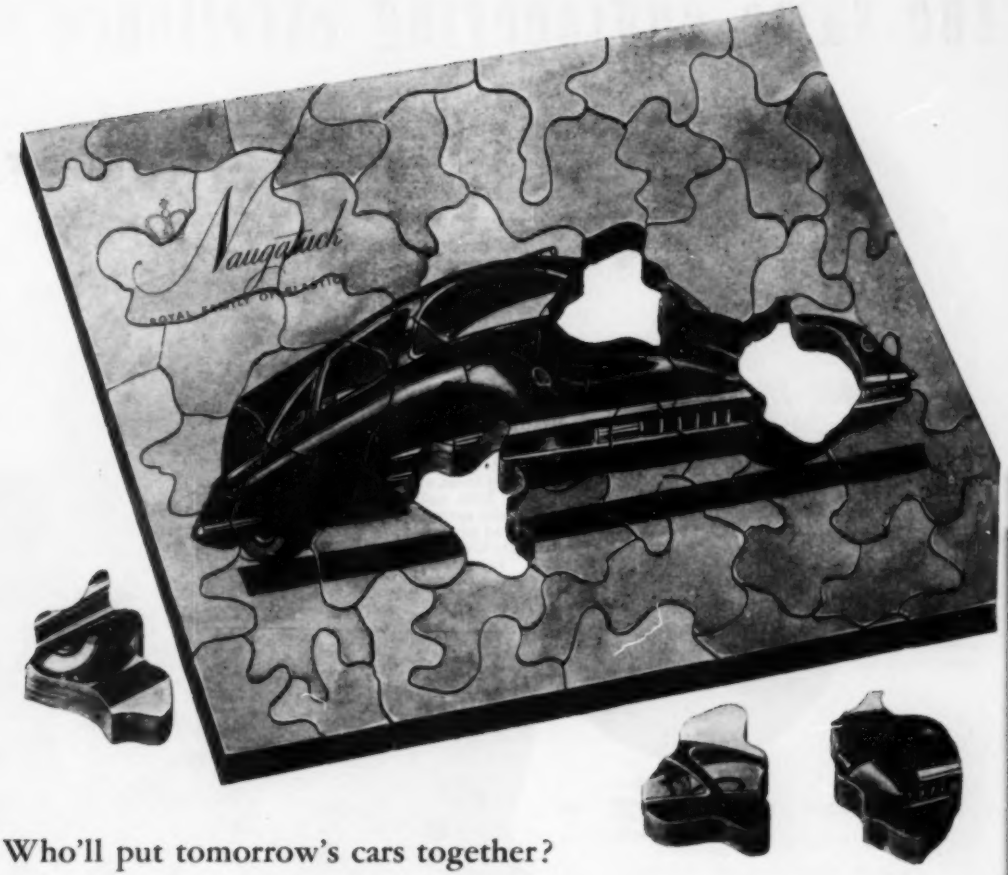


For further details of Farrel-Birmingham mills, send for a copy of Bulletin 173. No cost or obligation.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo, N.Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

Farrel-Birmingham



Who'll put tomorrow's cars together?

If you were making **automobiles, would you consider our new Vibrin polyester?**

What kind of fenders would this polyester make? The answer is here—thermo-setting polyester laminates have already produced the fenders every husband hopes for. They're dent-proof.

What about the car body itself? No need to guess—the automotive world has seen its first polyester roadster body. And an eye-opener it is!

Lighter than the lightest common metal.

Stronger than the strongest metal.

A solid surface-to-surface color that won't chip, crack or peel and a beauty to behold!

Resistant to everything that bothers automobile bodies—weather, water, exhaust fumes, sun, everything.

Produced with fewer pieces—with or without pressure or heat—at a small percentage of metal toolage costs.

Does this mean your car of the future will have "Body by Vibrin"? No one can tell now. But you can tell that the unusual polyester properties of Vibrin laminates can do fine things for your products from buttons to bathtubs. Investigate today.

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Division of **UNITED STATES RUBBER COMPANY**
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Without charge, send technical data on properties, uses, handling methods (specify desired end products).

I understand that, from this data, I can order suitable, free experimental samples.

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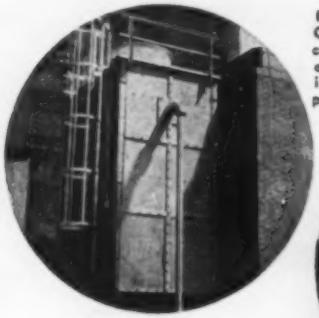
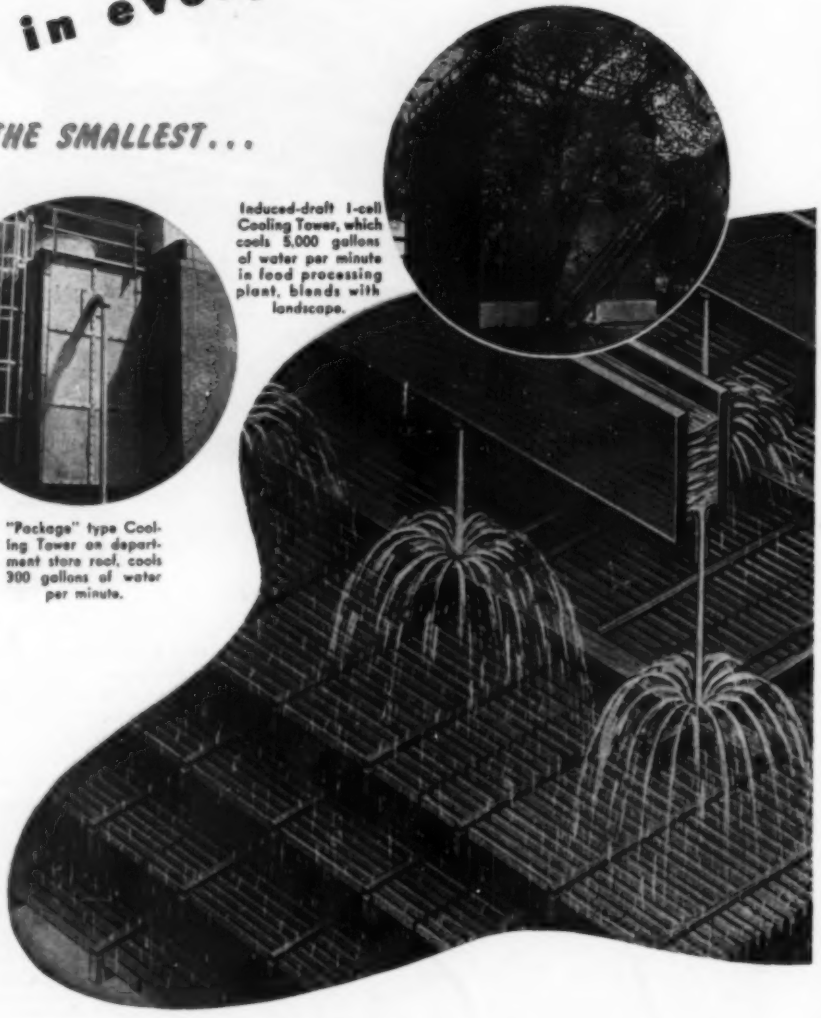


"Package" type Cooling Tower on department store roof, cools 300 gallons of water per minute.

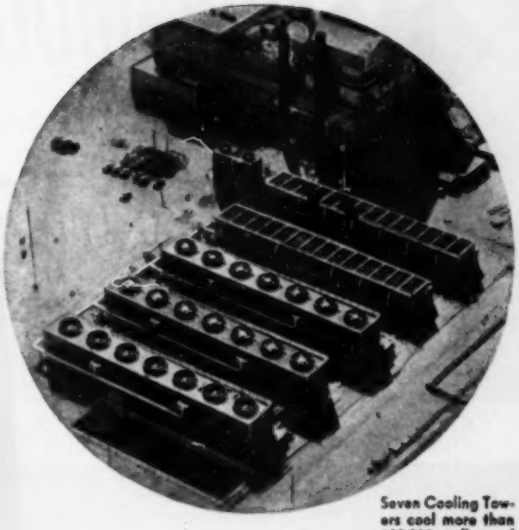
Induced-draft 1-cell Cooling Tower, which cools 5,000 gallons of water per minute in food processing plant, blends with landscape.



FOSTER WHEELER CORPORATION 165 BROADWAY

cooling tower

Induced-draft Cooling Tower in oil refinery cools 15,000 gallons of water per minute to within five degrees of the design wet bulb.



Seven Cooling Towers cool more than 180,000 gallons of water per minute in large power plant.

. . . TO THE LARGEST

Whatever the application—a "package" type on a department store roof in New York City, a twenty-cell tower for a power plant in Arkansas, or a large unit for a chemical plant in India, Foster Wheeler Cooling Towers can be depended on to deliver full capacity in year-round service.

A Foster Wheeler Cooling Tower is your best guarantee of a constant supply of cooling water for steam power plants, processing, air conditioning, or other uses. Regardless of size, the same engineering and construction excellence, the same attention to detail and the same quality of materials go into every Foster Wheeler installation.

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Ends Powder Caking for DAVIES-YOUNG

For some time, Davies-Young's detergent, "Dy-Sulph," had been produced in a small way in a ribbon blender. Disadvantages of that method were two-fold: the blender was too small and the blended powder had a tendency to cake. One of their suppliers recommended a **p-k** Twin Shell Blender* as the most satisfactory way of overcoming both difficulties.

Today, production has been materially increased, the powder is perfectly uniform, with the caking factor eliminated. Cleaning is simplified by the baffle-free design of **p-k** Blenders—loading and unloading time has been reduced. **p-k** Twin Shell Blenders mix dry materials faster and to greater uniformity than any other blender. Production units have a capacity range of from 1 to 250 cubic feet and operate at speeds from 6 to 29 rpm.

You will want to know more about the uniformity and increased production obtainable with **p-k** Twin Shell Blenders—send for catalog 401 on production models and catalog 402 on laboratory models. **p-k** will be pleased to run a test blend of your materials to demonstrate the outstanding merit of this new but service-proved method of dry blending.

*Patented

Convenient loading

Fast closing

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PICCOUMARON

Para-Coumarone-Indene

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A GROUP OF THERMOPLASTIC SYNTHETIC RESINS USEFUL FOR÷

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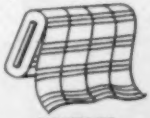

TEXTILES

The applications shown above indicate some of the almost endless uses for this excellent resin.

Piccoumaron Resins are available in grades from liquids to brittle solids. Colors vary from pale yellow to deep reddish brown. They are soluble in coal tar, turpentine, terpene and most chlorinated solvents. Good resistance to acids, alkalies and salt.

PICCO

Write for samples and complete data on PICCOUMARON Resins.

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Clairton, Pennsylvania

Plants at

Clairton, Pa.; West Elizabeth, Pa.; and Chester, Pa.

Distributed by Pennsylvania Salt Chemical Co., Pittsburgh 30, Pa. and Harwick Standard Chemical Co., Akron 5, Ohio

the *Inside* Story

on Better Pumping Performance

Look at the "insides" of a Fairbanks-Morse Single-Stage Split-Case Centrifugal Pump.

Note how easy it is to inspect or service all working parts . . . the ease with which the entire rotating element can be removed without disturbing driver or pipe connections. It means lower maintenance costs . . . less lost operating time.

Note the sturdy construction and exceptional strength provided by the arched casing and solid pump base . . . the one-piece impeller that reduces wear and maintains efficiency . . . the integrally cast bearing brackets that maintain accurate, permanent alignment of shaft and impeller.

These are but a few of the many performance-making features you'll find that mean more years of efficient, economical service.

FAIRBANKS

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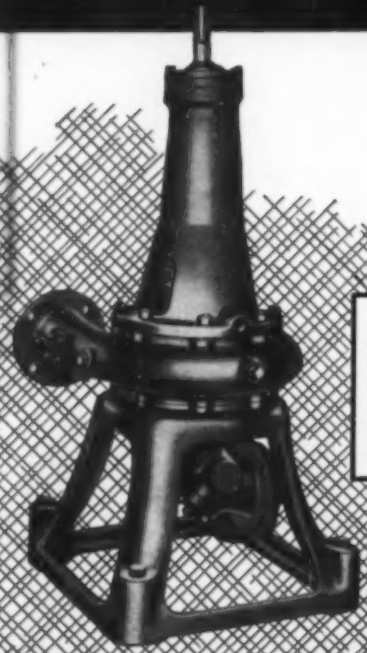

. . . and for another "inside" story, look over the amazing new Fairbanks-Morse "Bladeless" Impeller Pump. Here's the ideal pump where your requirements involve the handling of solids. As indicated in the phantom view of the impeller, there are no "blades" to catch or damage pumped material. Food products, for example, can be pumped without damage.

For process handling applications . . . food, chemicals, in fact any application where products are transported in a liquid, the Fairbanks-Morse "Bladeless" Impeller Solids-Handling Pump will pay dividends in lower costs . . . more efficient operation.

don't "Figure" it . . .

READ it to speed weighing . . . stop errors

With Fairbanks-Morse Direct Reading Cabinet Dial Scales, you read the *correct* weight right at the point of the indicator from zero to full capacity *regardless of the number of drop weights used!* This exclusive Fairbanks-Morse development speeds and simplifies weighing . . . minimizes the chance for costly human error.

No mental calculations are required. Drop weights are applied by an easy-acting hand crank. And as the weights are applied, a revolving disc automatically changes the figures on the chart.

You'll find Fairbanks-Morse Direct Reading Cabinet Dials provide the "easy way to weigh" for sustained accuracy and fast operation.

Here's how the Direct Reading Dial eliminates mental calculations. Illustrated above is a small segment of a dial chart. Without drop weight, the figure in the chart window reads 700 pounds. If one drop weight is applied, the figure in the chart window automatically changes to read 1700 pounds.

-MORSE

REMEMBERING

See Next Page for
FAIRBANKS-MORSE
Sales Centers

for the ultimate in automatic weighing,

Fairbanks-Morse Direct Reading Cabinet Dials can be equipped with Printomatic Weighers to provide automatic recording of weights on a ticket, roll tape or both. Printomatic recording eliminates the possibility of human error and assures a permanent, accurate record of all weighing operations. In addition to weights, other features such as identifying symbols, time, date, etc., can also be recorded simultaneously. It's the ultimate in fast, accurate weighing.

Full Capacity Beam

Bench Dial Scale

Portable Dial Scale

MOST Advantages for MOST Motor Applications

STANDARD DRIP-PROOF MOTORS FOR YOUR PROTECTION

Practically every motor needs protection—from flying chips, falling particles, dripping liquids, and the like. Also, by far the majority of motors used are of the polyphase, squirrel cage type.

These requirements are met to a unique degree by this series of Fairbanks-Morse motors—with built-in protection and superior electrical and mechanical design that account for their popularity throughout industry.

Whether your motor application problems involve driving pumps, machine tools, compressors, elevators, fans—or any of an infinite number of other applications—Fairbanks-Morse Standard Drip-proof Motors deserve your early investigation. Call your nearest Fairbanks-Morse Sales and Service center.

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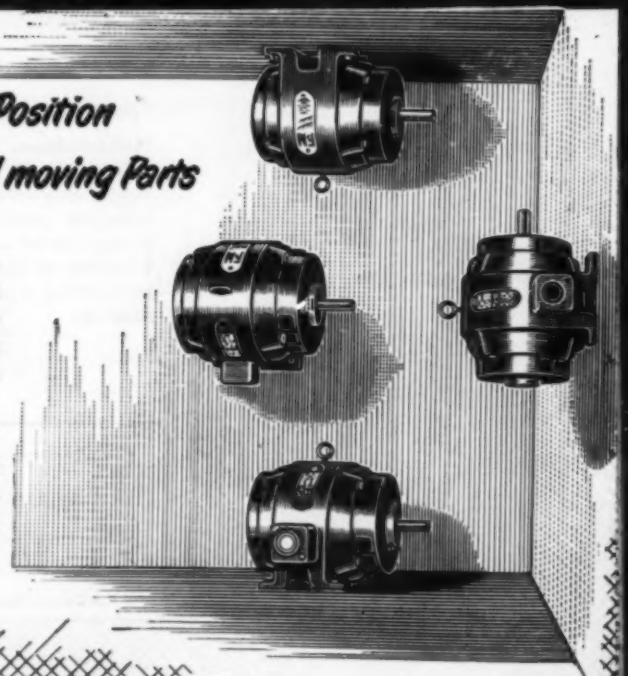
PROTECTION.. *in any Position*
SAFETY.. *no Exposed moving Parts*



Mount these motors anywhere—even on the ceiling or walls. Bearing arms have four bolts spaced 90° apart, enabling the bearing brackets to be adjusted to assure maximum protection. Motor can be mounted vertically without any changes in bearing construction.

There is complete safety for the operator. Fingers can even be placed in vents, for it is not possible to contact fans due to the protective shield. Smooth, streamlined external contour makes the motor easy to keep clean, easier to maintain.

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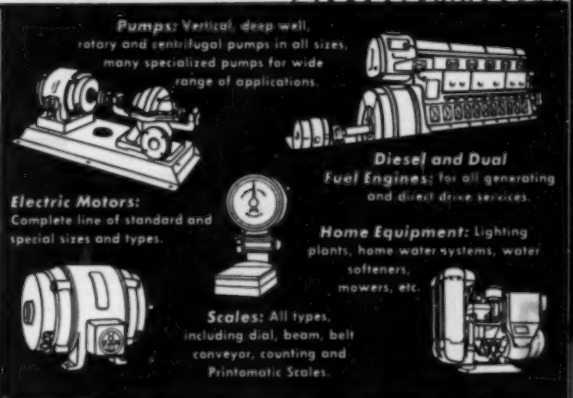
CALL YOUR FAIRBANKS-MORSE SALES CENTER

You need all the help you can get these days in procuring new equipment—in obtaining parts and repair service to keep your older equipment running at peak output. You'll find your Fairbanks-Morse Sales Center geared to help you in all these important efforts. It is staffed with factory-trained sales and service personnel, ready to give complete engineering assistance in product maintenance and application.

Unbiased advice is assured, for the Fairbanks-Morse lines of motors, pumps, scales and diesel engines are long and complete: helpful assistance is assured too, for you know you will be dealing with experts in the product in which you are interested.


Pumps: Vertical, deep well, rotary and centrifugal pumps in all sizes, many specialized pumps for wide range of applications.
Diesel and Dual Fuel Engines: for all generating and direct drive services.
Electric Motors: Complete line of standard and special sizes and types.
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TYGON

Versus NaOH

SODIUM hydroxide, by any name — "caustic," "caustic soda," "lye or soda lye" — is always a hard-to-handle chemical. But you can handle it — handle it with ease and safety—by calling on the versatile TYGON family of plastic compounds. TYGON, in any of its forms, through proper use, can help you cut corrosion costs — can increase your plant safety—can improve your factory housekeeping.

Basically, TYGON consists of a series of skillfully modified polyvinyl resins carefully compounded to give the best in chemical resistance and general physical properties. Each specific formulation of TYGON—each recommended use — results from decades of experience in corrosion control, and years of leadership in the use of vinyl resins to combat chemical attack.

As a calendered or press-polished sheet, TYGON can be used effectively to line tanks, drums, hoppers, bins, fume hoods, or fume ducts. The sheets can also be die-cut into gaskets, washers, and diaphragms for use as reliable, resilient seals or separators on all types of process equipment.

In tank lining or equivalent use, TYGON is resistant to caustic soda in concentrations up to 25% by weight and at temperatures as high as 150°F. As a gasket, or the like, TYGON resists all concentrations of caustic with temperature limits depending upon the design of the piece and the operating pressures involved.

In extruded form, TYGON is generally used as tubing or piping. However, the tubing, and extruded cord, channel, or tape, also finds use as gasketing, expansion jointing, packing, or wrapping.

TYGON Tubing is a familiar sight in the laboratory where its long life, full flexibility, transparency, and ease of use have put glass and other tubing in the background. The larger sizes, up to 2"ID, are likewise becoming commonplace in the plant for use as flexible piping in temporary or permanent transfer lines for both liquids and gases, as flexible connections, as inlet and outlet ports on pumps, filters and compressors, as syphon hoses, and as line desurgers. For pressure applications exceeding a constant head of 40 psi, particularly at elevated temperatures, braided jacket reinforcement is available and suggested. In all plant uses, the light weight, maneuverability, smooth surface, and abrasion resistance of TYGON Tubing add up to definite advantages over conventional piping.

Extruded, TYGON resists sodium hydroxide in any strength and at temperatures in the range of 150°-175°F. The temperature limit varies according to the wall thickness of the tubing, the use of braided reinforcement, the pressures involved, and whether or not the extrusion is supported or confined.

In molded form, TYGON exhibits approximately the same resistance as in the extruded form. Its uses are numerous and include application as gaskets, grommets, stoppers, closures, washers, bumpers, handles and special fittings. Where necessary, TYGON can be reinforced with glass fibers for added strength. Once again, specific temperature limits depend upon the size and design of the piece, the pressures involved and other conditions of service.

TYGON Paint, generally, sees service as a protective maintenance coating. As such, or in any paint application, the physical limits of a thin film must be realized. TYGON Paint provides excellent protection against the spillage or condensate of caustic soda in any concentration and at temperatures as high as 200°F. Prolonged immersion, however, is not recommended without the counsel of U. S. Stoneware engineers. In most cases, the minimum system recommended for caustic service consists of a primer and no less than five top coats.

As a plastisol (TYGOFLEX), TYGON finds application as a heavy duty coating and in the casting or "slush" molding of flexible parts and fittings. Against caustic soda, the resistance of TYGOFLEX depends primarily on the thickness of the coating deposited, but generally is greater than that of the paint film.

Regardless of the form in which it is used, TYGON provides an excellent means of protection against not only sodium hydroxide and other alkalies, but a wide range of acids, oils, greases and water. The different forms and compounds available and the range of properties they exhibit permit the proper use of TYGON in many applications. Versatility and satisfaction in service is further assured by the custom engineering, compounding, and fabricating services available from the plastics and corrosion experts at U. S. Stoneware.

TYGON plastics

In addition to TYGON in its various forms, we also manufacture a number of other materials capable of handling sodium hydroxide in any concentration and under all types of operating conditions. These products include chemical stoneware and porcelain, acid proof brick and cements, and other organic linings and coatings.

Why don't you submit your corrosion problem, today? There's no obligation and we'll be pleased to be of assistance. So write, now! 252-C

THE UNITED STATES STONEWARE CO., Akron 9, Ohio

ENGINEERS, MANUFACTURERS, ERECTORS OF CORROSION-RESISTANT EQUIPMENT SINCE 1865

THE Chementator

Reg. U.S. Pat. Off.

Prepared under the editorial direction of Joseph A. O'Connor, News Editor

Record outlay for research next year

Watch for another boom in research and development in 1952. The hunt for new products and new uses for old products will be stepped up.

Here's the outlook as seen by the Research and Development Board:

Spending will hit $3 billion, a new high. Of that total, $1.7 billion will be spent by the government, $1.2 billion by industry and $100 million by colleges and universities.

Money spent for research has tripled in the last decade. The chemical industry has long known that research is a big and vital part of its business. That's what keeps it out in front.

RFC wants no alcohol now for butadiene

With a big enough supply of ethyl alcohol already earmarked to keep its plants running for several months in 1952, the RFC at present is making no further purchases or commitments for alcohol for the synthetic rubber program.

RFC Administrator Stuart W. Symington reports that over 100 million gallons of alcohol for the production of butadiene is now on hand or under commitment. This supply has been built up over many months at an average price of about 67 c. a gal., f.o.b. the RFC synthetic rubber plants.

Despite the fire at the Borger, Tex., butadiene plant last September, production of GR-S in November was back on schedule at a rate of 760,000 tons per year.

This month production will be even higher, reflecting the first increase as a result of the program for expanding production to reach an annual rate of 860,000 tons by mid-1952.

Shale oil cheaper than coal hydrogenation

Shale oil would be the cheapest source of synthetic liquid fuels, according to the report of the National Petroleum Council to Secretary of the Interior Oscar L. Chapman. Coal hydrogenation would be a much more costly means of producing liquid fuels.

For plants with a total capacity of 216,000 bbl. per day of liquid fuels, the cost of synthetic gasoline from coal hydrogenation would be 43.5 c. per gal.; from oil shale, 14.7 c. This compares with the present 12 to 13 c. a gal. paid for gasoline at the refinery.

What's more, it would take eight hydrogenation plants to produce 216,000 bbl. of liquid fuels daily, and they would represent a capital outlay of over $4 billion. The requisite five oil shale plants to produce the same amount would cost only $1.5 billion.

This report by NPC cost the Bureau of Mines $300,000; 115 companies were consulted; the 164 men who developed the information traveled 400,000 mi. It took a long time to compile; Secretary Chapman called upon NPC to undertake the study in April 1950.

NPC's estimate of the cost of coal hydrogenation was much higher than that made earlier by the Bureau of Mines. Even after adjustment of earlier cost data to present figures, the Bureau's estimates were about 20 percent below those of NPC. The Bureau omitted such items as certain off-site facilities, income taxes, profit on investment and other details.

The Bureau now has under way another study of coal hydrogenation costs. Ebasco Services, Inc., of New York will evaluate the Bureau's estimates based on a hypothetical 30,000-bbl.-per-day plant at Rock Springs, Wyo., and a hypothetical 30,000-bbl.-per-day plant in Union County, Ky. The study will include investigations of the need for additional housing in the areas of the proposed plants; items of operating costs, particularly maintenance and return on investment; labor requirements for each plant; methods of financing; and marketing of byproducts.

Ultimate objective of the Ebasco study is the "determination of the average required wholesale selling price of the gasoline and liquefied petroleum gas produced by coal hydrogenation plants over the life of the project based on costs of Jan. 1, 1951, and current selling prices of the byproducts." The Bureau expects Ebasco to take about three months to complete the job.

On shale oil, the Bureau and the National Petroleum Council weren't too far apart. The only large difference between the Bureau and the NPC resulted from alternate means of entering capital cost figures such as interest, taxes and profit.

Another titanium process

An electrolytic method, developed by Arthur J. Kerbecek, Jr., a graduate engineering student at Columbia University in New York, may prove to be the answer to the problem of extracting titanium economically in large quantities from its ores.

In Kerbecek's process, titanium metal is obtained

(Continued on page 104)

by reducing the chloride electrolytically. The chloride is prepared from the original oxide.

His process, fruit of three years of research undertaken at the suggestion of Dr. Colin G. Fink, can also be used for the reduction of zirconium, now sought by the AEC.

According to Herbert H. Kellogg, associate professor of metallurgy at Columbia, "There is reason to believe that Mr. Kerbecek's method may be less expensive" than present methods of production. He plans to bring the process to the attention of titanium experts in the National Research Council.

But Prof. Kellogg and Kerbecek are quick to point out the need for further testing. Kerbecek says the results of his research may be tested in a pilot-plant operation.

The process might produce titanium for about $2 a lb., Kerbecek thinks. Currently, it costs about $5 a lb. But the Navy claims that the new process of Horizons Titanium Corp. will cut the cost to $1 a lb. or less. It's also an electrolytic method.

In addition to the cost of production, another stumbling block is that, so far, Kerbecek has produced no titanium of the better than 99 percent purity required for commercial use. But he's confident that this can be done.

Fourth producer to make aluminum

Anaconda Copper Co. is going into the aluminum business. It will put up a $46 million reduction plant at Kalispell, Mont.

Harvey Machine Co., which had unsuccessfully attempted to get government loans for the same venture, will relinquish the Kalispell site and its option on power. In return, Harvey will get a minority interest in the undertaking.

Anaconda is ready to finance the $46 million plant, which will have a capacity of 108 million pounds annually.

Three producers, Alcoa, Reynolds and Kaiser, now dominate the field. The government has been trying for more than a year to complete negotiations with one or more prospective producers.

Anaconda's entry into the aluminum field eliminates the need for direct government loans such as Harvey had sought. And getting into aluminum is a nice hedge for Anaconda against any post-crisis invasion by aluminum of such lucrative markets for copper as electrical conductors.

Dow keeps growing

Dow Chemical Co., which has spent an average of $59 million a year on expansion since the end of World War II, is spending $125 million in the current fiscal year.

Dow has asked the government for a total of $300 million in fast tax writeoff certificates. So far, the company has received $140 million. The other $160 million is pending.

How chemicals fared in six-year expansion

Chemical industry shelled out $771.4 million for construction of new facilities in the six-year period from July 1945 to June 1951.

Texas led all other states in chemical construction with a dollar volume of $197.6 million. Illinois was second with $50.7 million, followed by Ohio with $45.1 million and Michigan with $39.8 million.

Petroleum and coal industries spent $557.5 million for construction in the six-year period, and again Texas was a prime factor. Texas accounted for 42 percent of the nation's expansion in the petroleum industry. Of the total spent by the petroleum and coal industries, Texas got $234.8 million. Much of this is traced to the laying of major oil and gas pipelines.

The paper industry spent a total of $346.4 million. Alabama got most of this, with $82.2 million. Texas was second with $36 million and California third, with $27.2 million.

Another process industry spending a tidy sum for expansion was the stone, clay and glass industry. Construction expenditures for this industry came to $154.3 million.

Primary metals industry, reflecting vast new steel, aluminum and copper plants, topped all other industries in construction of new facilities during the six years. A total of $1,250.9 million was spent for expansion by producers of primary metals. This was 26.2 percent of the $4,771.4 million total for all types of industrial construction. Chemicals were second.

Pennsylvania got most of the $1,250.9 million spent for primary metals facilities, reporting $439.3 million. Texas was second with $191.1 million in this category, and Ohio third, with $114.3 millon.

The 10 states leading in volume of plant expenditures for the six-year period had 2,217 construction contracts amounting to more than $3.25 billion, an average of more than $1.4 million per contract. The other states averaged slightly less than $1 million.

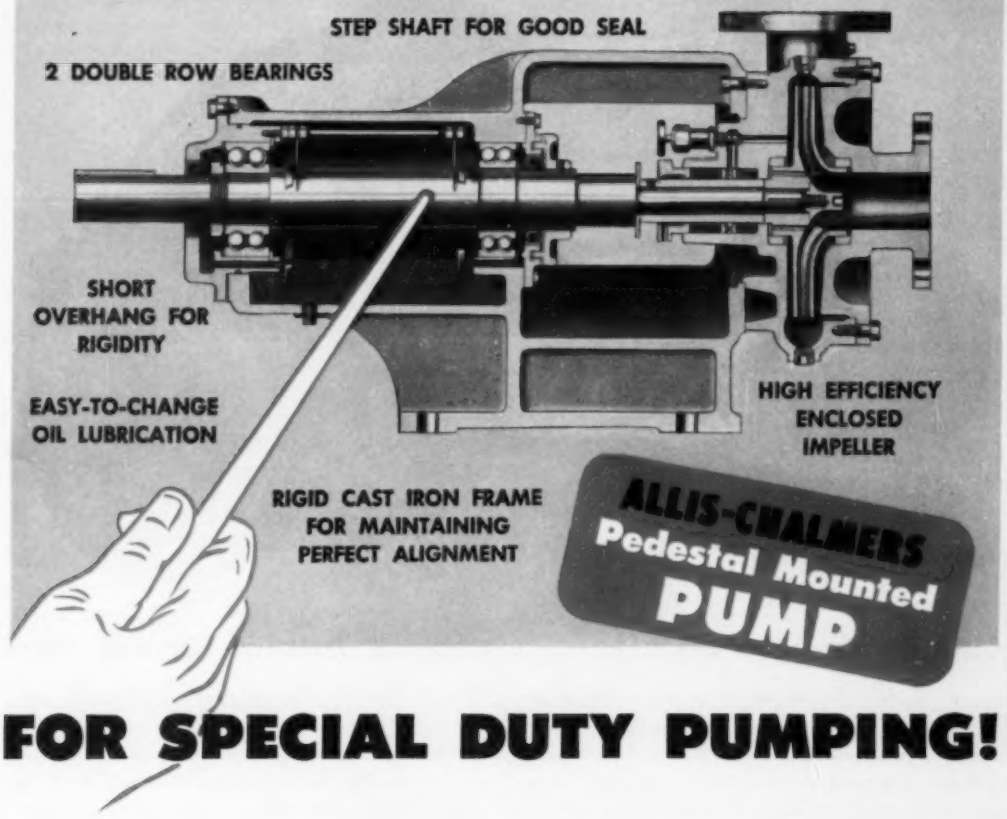
The 2,217 contracts in the 10 leading states represent 59 percent of the contracts reported and 68 percent of the total expenditures.

Texas led the states in number of contracts with 437 and also ranked first in expenditures for construction, which amounted to $735 million. Pennsylvania, second to Texas in expenditures, had more than one-third of the national expenditure in the primary metals industry. Illinois ranked second in number of contracts and fifth in expenditures.

Pennsylvania had 304 major contracts, with an aggregate dollar value of $573.6 million. Ohio was next with $364.8 million, followed by California with $336.5 million and Illinois with $330.8 million.

(Continued on page 108)

Look at This.


STEP SHAFT FOR GOOD SEAL
2 DOUBLE ROW BEARINGS
SHORT OVERHANG FOR RIGIDITY
EASY-TO-CHANGE OIL LUBRICATION
HIGH EFFICIENCY ENCLOSED IMPELLER
RIGID CAST IRON FRAME FOR MAINTAINING PERFECT ALIGNMENT
ALLIS-CHALMERS Pedestal Mounted PUMP

FOR SPECIAL DUTY PUMPING!

Easily Made Factory Modifications Make This Pump Ideal for Your Special Duty Jobs!

LET THIS PUMP meet your problems of: ☞ temperature, ☞ corrosion or ☞ contamination.

A wide combination of optional constructions and materials can be used . . . for example, six alternate sealing arrangements. In addition, materials for wetted parts are available, to resist attack of acid and alkaline liquids.

Moreover, Allis-Chalmers application engineers have experience in handling many types of liquids. They will help you choose exactly the right combination of materials and modifications to give you low cost per gallon pumped.

Allis-Chalmers can furnish the complete pumping unit —pump, motor, drive and control — all mounted on a rigid base ready to install and run. You save time and installation cost. Guarantee covers the complete installation.

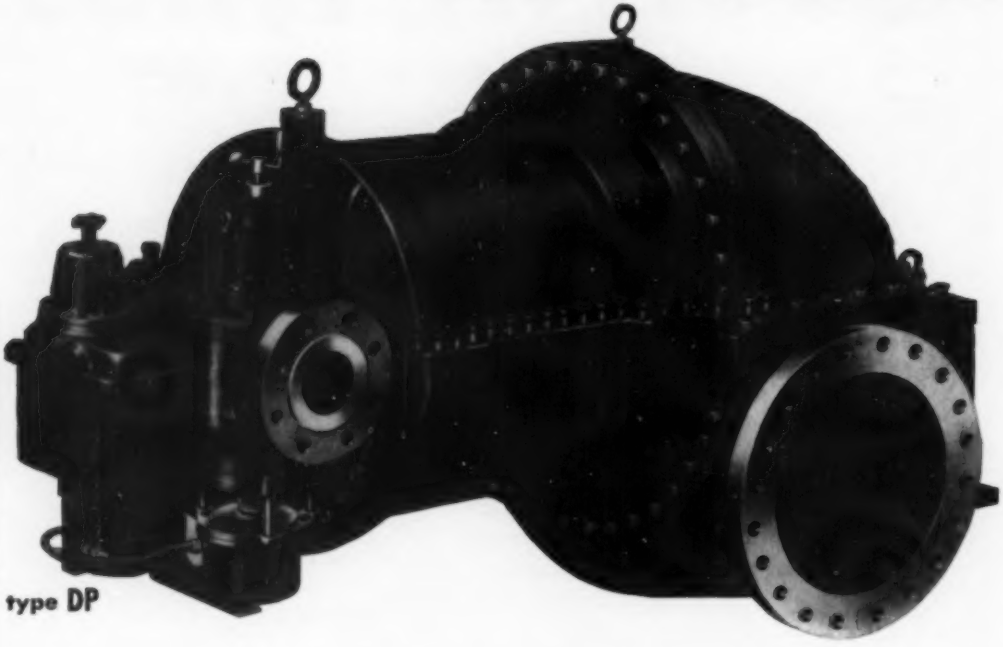
Capacities to 1200 gpm; heads to 250 feet; temperatures to 500 degrees F. Call your A-C district office for Bulletin 52B7638, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-2549

ALLIS-CHALMERS AC

General Electric Announces

A NEW ADVANCE IN



type DP

Custom Performance from Standard Turbine Drives now possible through new Designs and Manufacturing Methods

Now you can select the mechanical-drive turbine that will give you maximum mechanical power for your fuel dollar . . . and without the delay and expense of special engineering. General Electric's four new multi-stage drives are *standards,* designed to meet your *specific* requirements.

Four new governing systems give you a wide selection of performance ratings. A new sectional valve gives you greater efficiency for part load operation. Many other improvements make these the finest turbines of their size General Electric has ever produced.

Secret of their adaptability is in the method of manufacture. By using interchangeable casting patterns, designed to be combined in a variety of ways, it's possible for the factory to "customize" standard machines for individual applications. You get a better turbine, designed for your job, and the delivery time is shorter, the cost lower.

Get the full particulars on these new multi-stage turbine drives. Write for our new bulletin, GEA-5580, "G-E Multi-Stage Turbine Drives." General Electric Company, Section 252-53, Schenectady, N. Y.

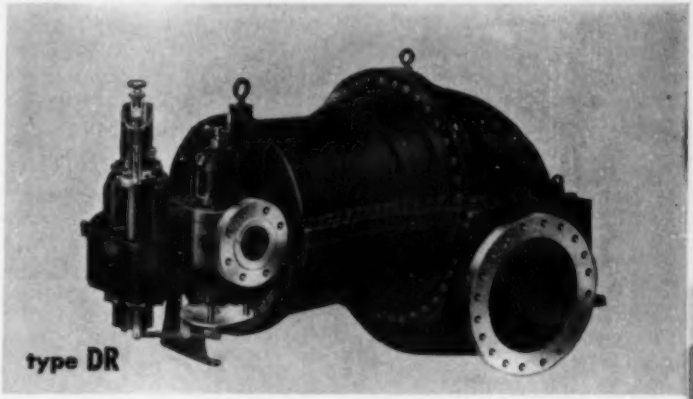
GENERAL ELECTRIC

252-53

MULTI-STAGE TURBINE DRIVES

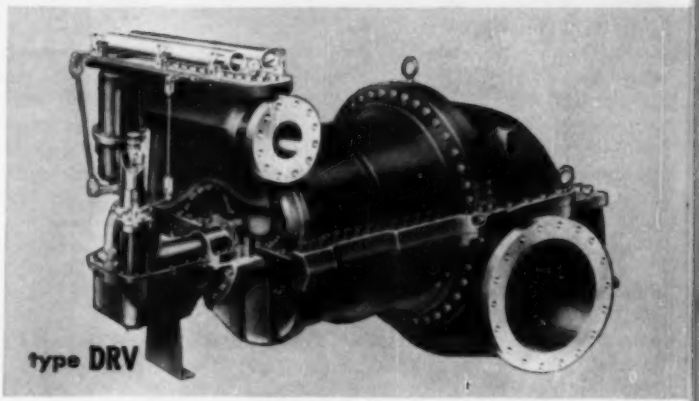
type DP

Dependable power over a 30 per cent adjustable speed range.



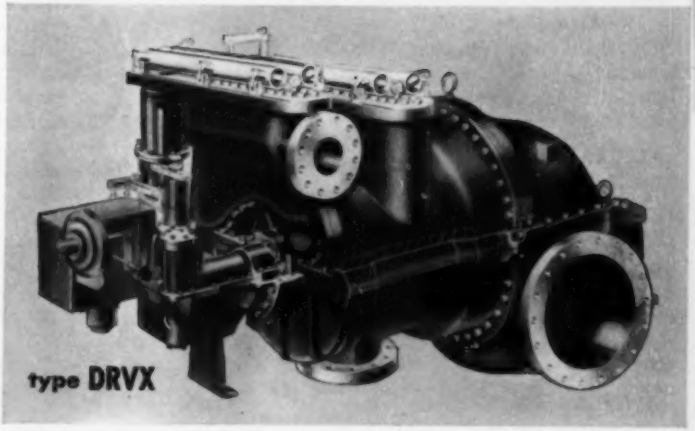
type DR

Oil-relay governor makes possible a speed range of 6 to 1, with only 4 per cent regulation and ½ per cent steady state speed variation.



type DRV

Automatic sectional valves linked to the oil-relay governor minimize throttling losses under fluctuating load factors, make possible substantial operating savings.



type DRVX

For applications where process steam is desired at a definite, steady pressure. Extracted steam pressure remains constant even when load on the unit fluctuates and the flow of extracted steam varies.

Next in line was Michigan, with $266.3 million; Alabama, $186.2 million; Indiana, $164.7 million; Louisiana, $159.4 million; and New York, $140.3 million.

Two new chemical plants near Houston

Du Pont has acquired option on 500 acres on the Houston Ship Channel between Beaumont and Port Neches. The site will be occupied by a multi-million dollar chemical plant.

Heyden Chemical has purchased a 60-acre tract, also on the Houston Ship Channel, near Houston. It will be the site for a plant to produce methanol and other products.

Taft-Hartley covers government plants

A chemical company making a product for national defense is subject to the Taft-Hartley labor law even though the plant and materials are owned by the government.

The National Labor Relations Board so ruled in ordering an election for employees at the Corpus Christi, Tex., plant of Great Southern Chemical Corp. Employees will vote on whether they want to be represented by the CIO Oil Workers, which petitioned for the election, or by the independent union recognized by the company.

The board turned down the company's request for dismissal of the petition. It rejected the company's claim that it was exempt as a government agent, that it is not an "employer" and not in interstate commerce.

Great Southern Chemical, which leases the plant from the RFC, is a government contractor subject to Taft-Hartley, the board ruled, even though it processes *n*-butane, supplied by the Office of Rubber Reserve, into butylene for government use. The board also upheld an earlier ruling that government title to material doesn't exempt a government contractor from the law.

NLRB found that, even though RFC determines operating policies, Great Southern is an "employer" since it controls hiring and firing, and has recognized the independent union for employee negotiation.

Record year ahead for fertilizers

Fertilizer demand during the coming year is expected to be the greatest in history. Total production of all kinds of fertilizers will probably be up at least 1 percent, with nitrogen output increasing 5 percent and potash output up 5 percent over 1951.

But superphosphate production may drop 10 percent. This will be due to unprecedented priority demands for sulphur and sulphuric acid by defense industries. Hence the anticipated shortage in phosphate fertilizers.

Uranium from phosphate rock

SIGNIFICANCE—AEC is barreling ahead with its plans for getting uranium from phosphate rock. Convinced that the tremendous tonnage mined each year makes rock an important U. S. source of uranium, the AEC looks forward to the day when most producers of phosphate fertilizers will recover uranium as a byproduct.

While other processes aren't being overlooked, recovery of uranium from wet-process phosphoric acid looks like the best bet so far. New plants now being built will get byproduct uranium that way.

This is going to have great impact not only on uranium production but also on the economic pattern of the phosphate fertilizer industry. It will accelerate the trend toward production of more concentrated fertilizers. And, more important, it will significantly affect the future of wet-process acid.

FROM WET-PROCESS ACID—Ever since it was discovered that phosphate rock in Florida and in the western states contained uranium, the AEC has been hard at work on ways to get it out. For even though most marine phosphate rock contains less than a pound of uranium per ton of rock, the enormous tonnage mined makes uranium recovery worthwhile.

So far, recovery from wet-process phosphoric acid looks easiest. In the manufacture of wet-process acid, most of the uranium in the rock is dissolved when the rock is treated with sulphuric acid. When the slurry is filtered, most of the uranium is found in the phosphoric acid.

In a pilot plant at Pittsburg, Calif., Dow Chemical pushed work on this method of getting uranium out of wet-process acid. Next, a larger unit was built at East Tampa, Fla., by the U. S. Phosphoric Products Division of Tennessee Corp. Now operating, it provides data for design of full-scale plants.

The first production plant to recover uranium from phosphoric acid is now under construction by the Blockson Chemical Co. at Joliet, Ill. Uranium will be recovered from wet-process acid in the new $10 million plant of International Minerals & Chemical now being built near Bartow, Fla., and in the new plant of Virginia-Carolina Chemical.

TRENDS—Production of byproduct uranium from phosphate rock will grow with the trend toward production of more concentrated fertilizers.

Unlike normal superphosphate, which is made by acidulation with sulphuric acid, concentrated superphosphates also require acidulation with phosphoric acid. Hence the move toward increased output of double and triple supers means greater demand for phosphoric acid.

This is just what AEC wants. In fact, to quicken this trend toward production of concentrated fertilizers and thus hasten the recovery of important amounts of uranium from this source, AEC is encouraging expan-

(Continued on page 110)

Cleveland vertical drives at the Gulf Oil Corporation's gasoline plant, Eunice, New Mexico. 25 units are utilized in cooling operations at this natural gasoline plant.

Trouble-free service for years with CLEVELANDS

HUNDREDS of Clevelands drive cooling tower fans at refineries. Reports from plant operators indicate that they are uniformly dependable. Regardless of dust and exposure to extreme heat and humidity, they operate continuously with minimum attention, at high speeds and for long periods of time.

Cleveland vertical drives are compact in construction, ruggedly built to operate anywhere under adverse conditions. They are engineered to carry the high thrust and radial loads normally encountered in cooling tower service. Simplicity of design makes for easy installation, adjustment and service in the field.

There are other Cleveland units available for any service where the many advantages of a powerful, right angle drive are desired.

Write for Bulletin 135 which gives a full description and technical data on the Type CU drive—Cleveland's special cooling tower unit. Ask also for literature on other types of worm gear drives.

The Cleveland Worm & Gear Company, 3273 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited

CLEVELAND
Worm Gear
Speed Reducers

sion of present facilities and construction of new ones to make wet-process phosphoric acid.

Uranium could be obtained from the phosphoric acid made. Then the acid could be delivered by tank truck or railroad tank car to normal superphosphate plants within economic radius. These normal super producers could substitute phosphoric for part of the sulphuric they now use and would make a more concentrated fertilizer for their customers. Higher-analysis materials can better stand the cost of being shipped long distances than can normal superphosphates.

OTHER METHODS—AEC continues to push research on a way to get uranium from normal superphosphate. That's because recovery of uranium from wet-process acid at present has one big hitch: only about 1 million tons of phosphate rock per year is used to make wet-process acid. The tonnage of rock used to make normal superphosphate is much larger.

AEC is also exploring the possibility of recovering uranium during the manufacture of phosphate fertilizers by nitric acid acidulation of rock. Production of phosphate fertilizers takes close to 1.5 million tons of sulphur a year. And with sulphur in such critically short supply, it's likely that sulphuric acid for acidulation will have to be supplemented or replaced by nitric acid.

GOAL—AEC's goal is recovery of uranium from every plant using phosphate rock. Many steps are being taken toward that end. In a pilot plant at Claymont, Del., General Chemical is investigating recapture of byproduct uranium during sodium phosphate manufacture. Mathieson Chemical Corp. at Pasadena, Tex., is just getting ready to install a pilot plant. And Armour Fertilizer Works is applying research findings to its Bartow, Fla., operations.

Byproduct uranium will come from many sources, each supplying but a trickle. However, as Sheldon P. Wimpfen of AEC points out, "In the aggregate, producers of wet-process acid in the phosphate chemical and superphosphate field are in a position to make an important and continuing contribution to our domestic supply of uranium."

Phenol from cumene

Another new phenol plant will use the cumene process. The first synthetic phenol plant on the West Coast, it will be built at the Richmond, Calif., refinery of Standard Oil Co. of California. Its cost: over $4 million.

To get around the current scarcity of chlorine and sulphuric acid, both used in present processes for making phenol, Stancal's new Richmond unit will utilize the recently developed synthesis of phenol from cumene. Acetone is the other product.

To get its cumene, Stancal will build a cumene plant at Salt Lake City at a cost of about $3 million. At the Salt Lake City plant, benzene will be alkylated with propylene to produce cumene, which is isopropyl benzene.

Initially, the Richmond phenol plant will turn out 35 million pounds a year. But the plant will be designed and built to make possible an increase in capacity to 50 million pounds per year of phenol if the market warrants.

The phenol will be marketed by Oronite Chemical Co., a Standard subsidiary. Big outlets for phenol in the Northwest are in the manufacture of resins for molded plastic parts and in plywood adhesives. Other uses: in the manufacture of dyestuffs, insecticides and other compounds.

On the East Coast, Allied's Barrett Division is already building an $8 million plant at Philadelphia to make phenol from cumene. It will produce about 25 million pounds a year, trebling Barrett's phenol capacity.

Meantime, the Canadians aren't exactly napping. A multi-million dollar phenol plant will be built at Montreal by the Canadian Kellogg Co., Ltd., a subsidiary of M. W. Kellogg Co. of New York, for British American-Shawinigan Ltd. A recently organized company, British American-Shawinigan is jointly owned by British American Oil Co. and Shawinigan Chemicals Ltd.

This plant will also produce phenol from cumene by a process licensed by Hercules Powder Co. of Wilmington, Del., and Distillers Ltd. of London. Cumene will be oxidized to produce both phenol and acetone. Cumene will be piped from the Montreal refinery of British American Oil Co.

The new Canadian plant, first of its kind in that country, will turn out 13 million pounds of phenol annually. Upon completion of the new unit, both phenol and acetone will be available for sale to Canada's rapidly expanding industry and for export.

It looks as though the current shortage of chlorine and sulphuric acid is accelerating the trend toward production of phenol from cumene, a process that requires neither chlorine nor sulphuric.

Out of the den, triple super

A Broadfield continuous den has been used successfully for the experimental production of enriched superphosphate and triple superphosphate at the Hattiesburg, Miss., plant of Meridian Fertilizer.

The tests, conducted by Chemical Construction Corp., showed that enriched superphosphate containing 24-26 percent P_2O_5 and triple superphosphate containing about 43 percent P_2O_5 could be produced in equipment heretofore used in the manufacture of normal superphosphate.

The operating technique was so simple that Meridian decided to use the leftover phosphoric acid for the production of triple superphosphate. —*End*

Tomorrow's Basic Chemicals-TODAY!
Many New Products Due Thru Use of Fluorine Chemicals
New Lubricants, Plastics, Solvents, Dyes, Other Materials in Offing
GENERAL CHEMICAL FLUORINE COMPOUNDS

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Anticipating Industry's expanding needs for fluorine compounds, General Chemical has conducted an extensive fluorine research program for more than two decades. With its basic position in Hydrofluoric Acid and Elemental Fluorine—and in the raw materials from which they are made—General is geared to produce virtually any fluorine chemical that Industry might require. Today, it offers over sixty-five such products. Many more are under development as commercial chemicals or as custom-made specialties.

If organic or inorganic fluorine compounds are indicated in your present or projected operations, consult with General Chemical first. You will find the broad experience of our fluorine specialists helpful to you from product inception to full-scale production.

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Hydrofluoric Acid, Anhy. (High purity grade)

ACID FLUORIDES
Ammonium Bifluoride
Potassium Bifluoride
Potassium Polyacid Fluoride "50"
Sodium Bifluoride

ALKALI FLUOBORATES
Ammonium Fluoborate
Potassium Fluoborate
Sodium Fluoborate

ALKALI FLUORIDES
Ammonium Fluoride
Potassium Fluoride
Sodium Fluoride

DOUBLE FLUORIDES
Potassium Aluminum Fluoride
Potassium Chromium Fluoride
Potassium Ferric Fluoride
Potassium Titanium Fluoride
Potassium Zirconium Fluoride

METAL FLUORIDES
Aluminum Fluoride, Crystal
Antimony Trifluoride
Antimony Pentafluoride
Barium Fluoride
Cadmium Fluoride
Calcium Fluoride
Chromium Fluoride
Cobalt Trifluoride
Copper Fluoride
Ferric Fluoride
Lead Fluoride
Magnesium Fluoride
Molybdenum Hexafluoride
Nickel Fluoride
Strontium Fluoride
Titanium Tetrafluoride
Tungsten Hexafluoride
Zinc Fluoride
Zirconium Tetrafluoride

METAL FLUOBORATE SOLUTIONS
Cadmium Fluoborate
Chromium Fluoborate
Cobalt Fluoborate
Copper Fluoborate
Ferrous Fluoborate
Indium Fluoborate
Lead Fluoborate
Nickel Fluoborate
Silver Fluoborate
Stannous (Tin) Fluoborate

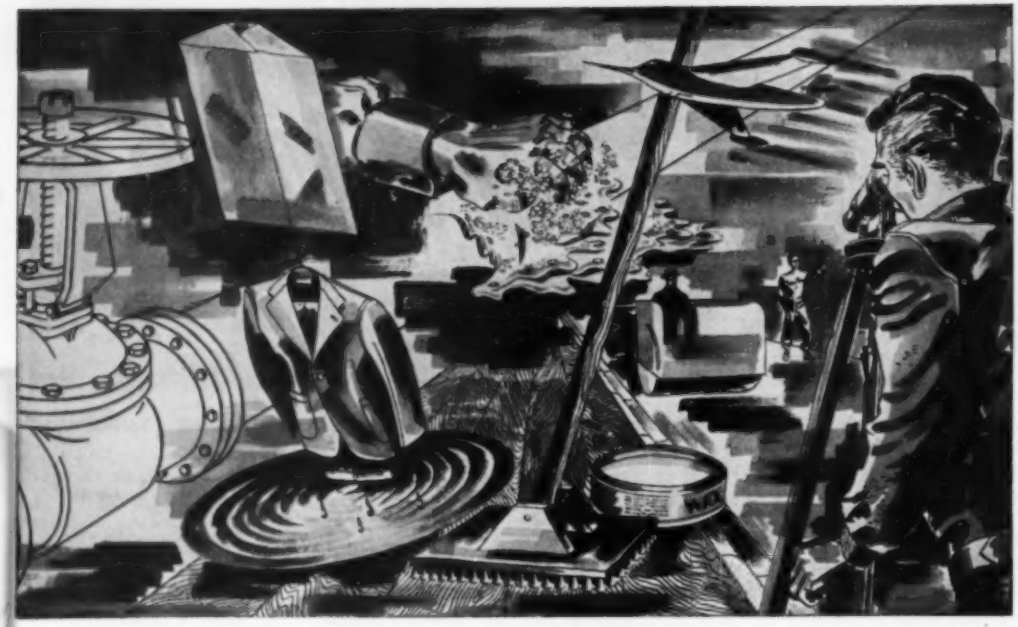
NON-METAL FLUORIDES
Boron Fluoride Gas
Boron Fluoride—Diethyl Ether Complex
Boron Fluoride—Phenol Complex
Boron Fluoride—Other Complexes
Sulfur Hexafluoride

HALOGEN FLUORIDES
Bromine Trifluoride
Chlorine Trifluoride
Iodine Pentafluoride

ORGANIC FLUORINE COMPOUNDS
Genetron® 100—$CH_3 \cdot CHF_2$
Genetron 101—$CH_2 \cdot CClF_2$
Genetron 131—$CCl_3 \cdot CClF_2$
Genetron 150—$CH_2 = CF_2$
Genetron 160—$CHCl = CF_2$
Genetron 170—$CCl_2 = CF_2$
Genetron 265—$CClF = CF_2$

* The products listed include those which are commercially available as well as a few presently produced only in experimental quantities. For further information on any of these, or on other fluorine compounds you may require, consult the General Chemical Product Development Department.

Dissolve your process problems with ROOSEVELT solvents



Every product you see here has one thing in common . . . each uses a Roosevelt aliphatic naphtha at some time during its manufacture or use. In many cases a specific process problem had to be solved . . . sometimes by the selection of a standard Roosevelt solvent . . . sometimes through the use of a special solvent, specially produced to the manufacturers' specifications.

As you can see Roosevelt solvents have wide application. Does your product fit into the picture? It does if you need an aliphatic naphtha solvent. If the solvent you need isn't "standard" at Roosevelt, we'll make it for you. Submit your specifications.

Write for your copy of Roosevelt's book of specifications. It's yours for the asking.

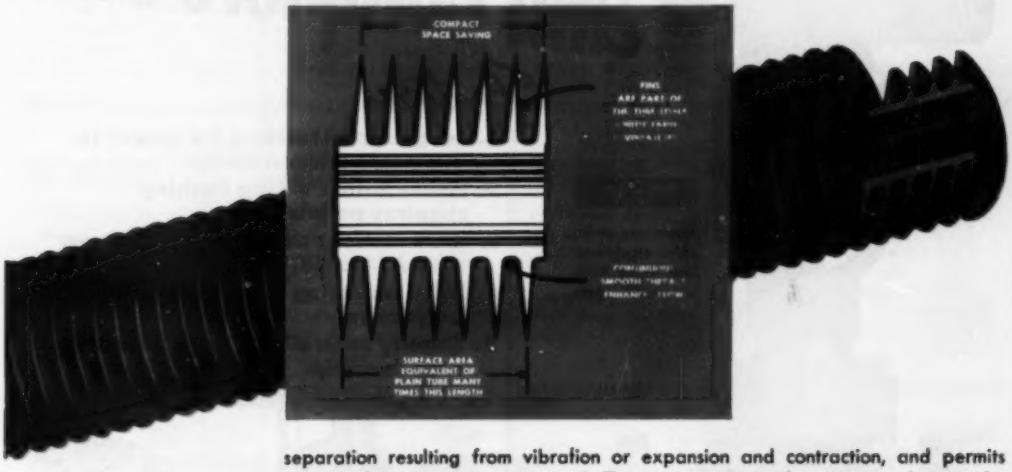
ROOSEVELT

HIGHER EFFICIENCY from less working space

These six words briefly describe the noteworthy performances that Wolverine Trufin*—the integral finned tube—is showing wherever it forms a part of heat exchangers.

As if developed expressly for the defense effort, Trufin is THE answer to today's cry for more production because it possesses the physical advantages of greater capacity.

Just a glance at its unique construction will tell you why Trufin performs so well. Note that the fins are part of the tube itself. Thus there is a positive, uninterrupted thermal flow. This one-piece construction removes the hazard of fin and tube



separation resulting from vibration or expansion and contraction, and permits more uniform temperature control. The space-saving advantage is obvious; the equivalent outside surface area of a 19" length of plain tube, ⅝" diameter, for instance, can be obtained in just one inch length of Trufin of the same diameter. The continuous, smooth surface between the fins, too, enhances the flow of liquids through them and lessens the tendency for the formation or accumulation of obstructions that necessitate more frequent cleaning.

Trufin is available in a variety of alloys, including bi-metal; in a wide range of sizes, fin spacings and heights. If you are retubing or installing new heat exchangers or condensers, consider Trufin—the tube recognized for its high efficiency.

Would you like a Bulletin that gives detailed information about operating heat exchangers efficiently? Ask for a copy on your stationery. *Reg. U. S. Pat. Off.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

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TYPE 57T

Diaphragm motor valve equipped with Fisher Positrol valve positioner.

Features:

1. Large superstructure for power to overcome friction losses.
2. Fisher Teflon V-Ring Packing requires no lubrication.
3. Wall sections and boltings conform with ASA code.
4. Yoke mounting boss for valve positioner.
5. Quality controlled materials and workmanship.

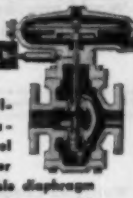
TYPE 530

High rangeability diaphragm control valve for small flows and high pressure drops commonly encountered in experimental and pilot plant operations.

TYPE 567

Reverse action topwork, generally used with push-down-to-close valves which must be spring closed in action.

TYPE 790R



Pressure balanced diaphragm control valve — either single or double diaphragm construction — for use with remote mounted instrument or pressure loader.

TYPE 57T-D

High pressure diaphragm control valve. Available in small sizes for 3,000 lbs. and 4,000 lbs. working pressure.

FISHER TEFLON V-RING PACKING

- No gland leakage.
- Used on wide range of pressures without appreciable change in friction values.
- Elimination of maintenance and adjustment.
- No valve stem lubricators required.
- Chemically inert to all fluids up to 450° F.

FISHER LEADS THE INDUSTRY

Industry's Most Versatile of Diaphragm Motor Valves

Illustrated here are just a few of the complete line of Fisher Governor Company diaphragm motor valves. They are manufactured to handle pressure conditions up to 10,000 pounds, for high pressure drops, for handling contaminated fluids (coke, sludge, slurry). Available in metals for highly corrosive service and alloys for high temperature work. They are built for your specific requirements with a wide choice of inner valves to provide desired flow characteristics.

TYPE 57T-DA

High pressure diaphragm control valve. Available in small sizes for 3,000 lbs. and 6,000 lbs. working pressures with angle body.

TYPE 5700

Springless type diaphragm motor valve, double diaphragm actuated. Power actuator suitable for up to 5,000 lbs. unbalanced thrust.

TYPE 1657S

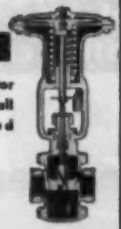
Three-way diaphragm motor valve with single disc, double seat, commonly used on flow diversion work.

TYPE 57T-K

Diaphragm motor valve with fully balanced inner valve with soft seat for tight closure.

TYPE 510S

Diaphragm motor valve with small single seated bronze body.



TYPE 461-462

Diaphragm motor valve with Sweep-Flo angle body and continuous connected handwheel diaphragm motor operator.

TYPE 7700

Diaphragm motor valve with butterfly valve construction for handling large volumes under low pressure drop conditions.

TYPE 5B1

Diaphragm motor valve, single seated, piston balanced with internal pilot.

TYPE 57T-L

Single seated, flapper check for low pressure drop installations such as meter runs.

TYPE 1657T

Three-way valve, double port, double disc, full throttling.

TYPE 57Q

Diaphragm operated single seated body, reversible without additional parts.

TYPE 57T

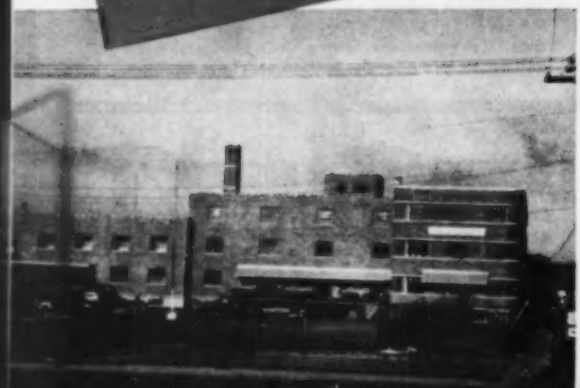
Standard diaphragm motor valve, available with variety of inner valve constructions.

FISHER GOVERNOR COMPANY, Marshalltown, Iowa

IN RESEARCH FOR BETTER PRESSURE CONTROL

Now more important than ever to you...

Fast LOCAL delivery



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There's no need to worry over possible production delays due to lack of the right cutting oil, lubricant, or fuel . . . no need to stock-pile these supplies in your own plant . . . no need to wait for help in solving your lubrication problems.

To take advantage of Standard's time-saving *local* lubrication service (now more important than ever to you) call the Standard office in your area. Or write: Standard Oil Company (Ind.), 910 South Michigan Avenue, Chicago 80, Ill.

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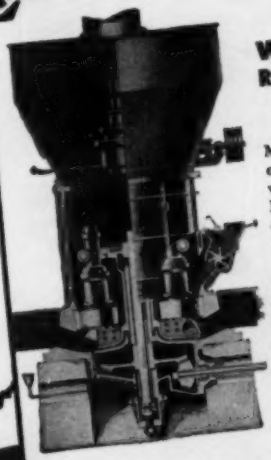
Heavy duty for crushing and grinding rock phosphate, gypsum, limestone, shale, bauxite, asbestos rock and other chemical and fibrous materials to small sizes in one operation.

Many sizes to choose from and capacity is unusually high and power involved and maintenance extremely low.

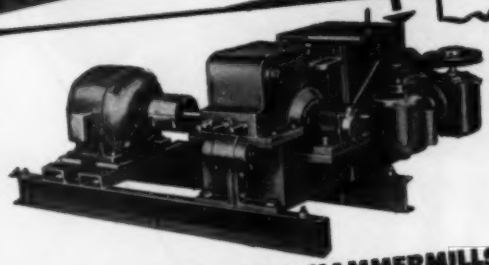


WILLIAMS ROLLER MILLS WITH AIR SEPARATION

Many materials are now economically pulverized with the Williams Roller Mill. Finenesses quickly changeable from 40 mesh to 400 mesh and materials may be dried and ground simultaneously.

Remarkable records are being made on insecticide mixes, pigments and dry colors and barytes, phosphate, limestone, etc.

WCS1-8C



WILLIAMS HELIX-SEAL HAMMERMILLS

Dustless fine grinding, 200 to 325 mesh, without the use of fans, cyclones or separators. Will also grind wet and sticky materials. Easy to install and inexpensive to operate. Variable speed control on feeder permits grinding of different kinds of materials.

W.T./M.G.P.*

***WILLIAMS TESTING...MEANS GUARANTEED PERFORMANCE**

Submit your grinding problems to Williams. A sample of the material and description of the desired result will set our facilities to work on a solution to your problem. Visits during test runs and technical consultations are invited.

WILLIAMS PATENT CRUSHER & PULVERIZER CO.

2706 N. Ninth St. St. Louis 6, Mo.

WILLIAMS

CRUSHERS GRINDERS SHREDDERS

...ND LARGEST MA... ...K OF HAMMERMI... ...WORLD

A digester being radiographed with two-million-volt X-ray equipment
QUALITY
BY THE TON
...process equipment by
B&W

Today, fabricating capacity and mechanical design facilities alone cannot provide an adequate solution to the equipment problems imposed by modern processing temperatures, pressures, and stepped-up cycles of operation.

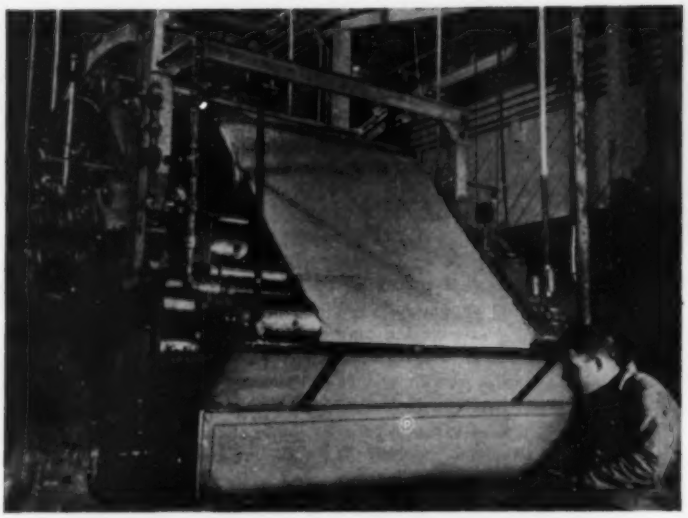
Design and construction of vessels and heat-transfer equipment necessarily involve such relatively new research data as creep characteristics and the metallurgy and methods of welding dissimilar metals and alloys. B&W is particularly well equipped . . . both by research and experience . . . for the proper selection of materials, their fabrication, and integrated assembly to meet the special requirements of modern chemical, petroleum, and food processing.

No matter how "big" you buy, you can still think in terms of *quality* — fine engineering, conscientious craftsmanship, experience, and the ultimate in critical inspection — when B&W contracts for the job. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

Quality material and workmanship are required for high alloys that operate at severely high temperatures

BABCOCK & WILCOX

B-4067



13% MORE PENICILLIN

... *Continuously*

WITH FEinc STRING FILTERS

FOOD PRODUCTS

PHARMACEUTICALS

CHEMICAL

A scraper-type filter, handling penicillin broth, was only 85% efficient—over 15% of the available penicillin was left in a wet, sloppy cake.

The manufacturer switched to a FEinc String Filter with a submergence washing mechanism. Better washing removed over 98% of the penicillin from the cake. More complete dewatering left a dry, firm cake, easy to handle for disposal.

In hundreds of cases, FEinc filters have proved their ability to do the job better, faster, and at lower cost. The famous String Discharge handles many "impossible" cakes, *continuously* filters slurries that would otherwise require batch processes. Special equipment for compression dewatering, cake washing, cake-scoring, drying, and repuddling can be added to the basic filter as required. You'll get a combination that's engineered to do *your* job best.

Find out how FEinc can save on *your* job. Send us a five-gallon sample of slurry. We'll run tests in our laboratory, give you a report on costs and performance. Or if you wish, we can run these tests in your own plant, without interrupting your production. No obligation, of course.

Send for free bulletin 1031

35

FILTRATION ENGINEERS INC.

155 ORATON STREET • NEWARK 4, NEW JERSEY

Many have tried...
More will try...
to imitate

DREW COCONUT FATTY ACIDS

To imitate is to compliment. And we *are* complimented by producers who try to imitate the composition, color, stability and freedom from odor of Drew Coconut Fatty Acids.

Invariably, two ingredients—lack of experience and specialized knowledge—doom such attempts to failure. It is Drew's possession of these, together with modern research and production techniques, that give you a product *plus* that is an essential part of every Drew Coconut Fatty Acid.

When you think of coconut fatty acids, remember these simple facts:

- Drew's coconut fatty acids are distilled and fractionated to improve odor, provide long-lasting color stability, and give greater soap value.
- Drew is one of the world's largest producers of coconut fatty acids.
- Wherever specifications call for quality coconut fatty acids, note how often you see the phrase: "E. F. Drew or equal."

If *quality* has made your product famous . . . if you want to establish *quality* in your product . . . don't be satisfied with imitations. Always specify Drew fatty acids.

Write for reference booklet, "Drew Fatty Acids"

Distilled and Fractionated Fatty Acids:

COCONUT LAURIC STEARIC OLEIC SOYA LINSEED COTTONSEED
CAPRIC CAPRYLIC MIXED VEGETABLE

TECHNICAL PRODUCTS DIVISION

E. F. DREW & CO., INC.

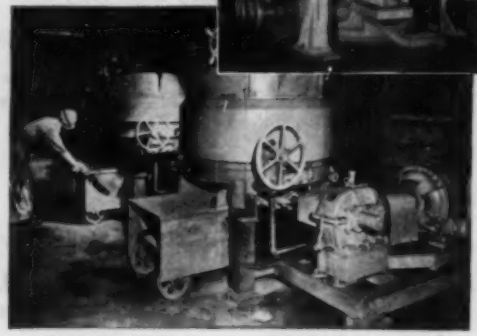
15 EAST 26th STREET, NEW YORK 10, N. Y.

CHICAGO PHILADELPHIA BOSTON

DREW PRODUCTS

Increase production — Cut Costs

7 TYPICAL INSTALLATIONS giving daily proof of Better Performance



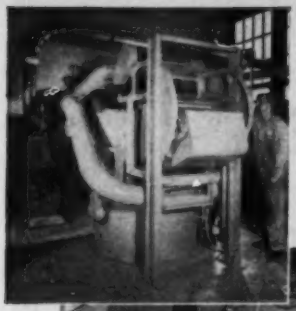
AT a time when industry is committed to its greatest effort, modern high-production equipment is vitally important. The seven Simpson Mix-Muller installations shown are representative of the way in which these high capacity machines serve the chemical-process industries.

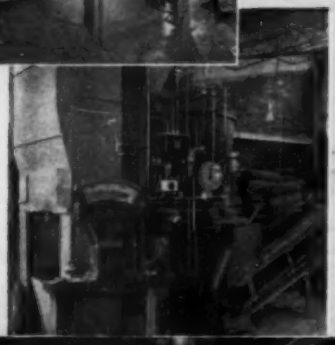
Here are carefully engineered mixers that have been proved superior in over 5,000 installations. Day-in and day-out operation has shown that blending is more accurate and thorough — the mixing cycle is shorter — and the cost per batch is considerably less, than in older mixing methods. Whether dry, semi-plastic, or plastic material is to be blended — the result is the same. That's because Simpson Mix-Mullers embody the *true mulling* principle of mixing.

THE MULLING PRINCIPLE OF MIXING

The thorough mulling of Simpson Mix-Mullers is similar to the rubbing, kneading and smearing action of a mortar and pestle. The machine consists of a circular stationary pan, in which is mounted a special combination of mullers and plows that revolve. The mullers are adjustable and are supported on rocker arms so that they are free to ride on the material, creating pressure and an intensive rubbing and smearing action as they revolve. This eliminates any balling of material and quickly develops a maximum plasticity of the mix. *No other method has ever proved more effective for fast, thorough, controlled mixing and blending.*

with SIMPSON *Mix-Mullers*





MAKE THIS SIMPLE *Smear Test* YOURSELF

Place a small amount of the product you are now mixing on a ground glass and run a spatula through the center of the mass. If the batch is not thoroughly mixed and blended — you will find tell-tale lumps or smears which ordinary examination would not reveal.

The above illustration shows the actual result of a test on a product in which thorough mixing was very important. Notice the absence of blotches in the upper smear . . . the result of *mulling* in a Simpson Mix-Muller.

This thorough controlled mixing plus speedier, lower cost operation are ample reasons for deciding on Simpson Mix-Mullers.

Simpson Mix-Mullers are built in capacities ranging from 1/10 to 30 cu. ft. They may be specially equipped for heating or cooling while mixing — for mixing under vacuum or pressure — for corrosive materials — or to function as a reaction vessel.

Write for complete details covering the use of Simpson Mix-Mullers to meet your individual requirements . . . or send for a copy of our latest Chemical-Process Mixing Catalog.

SIMPSON *Mix-Muller® Division*

NATIONAL ENGINEERING CO. 624 Machinery Hall Bldg. Chicago 6, Ill.

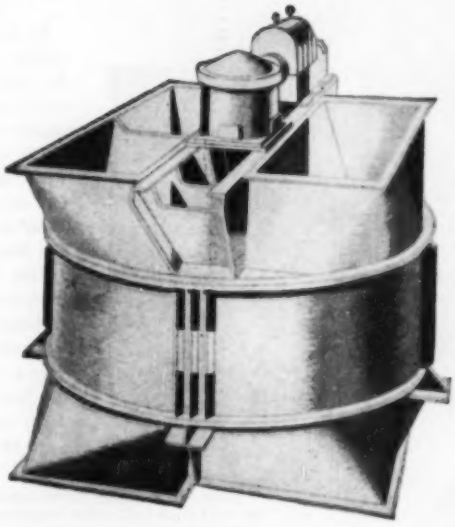
this preheater is cutting fuel costs in hundreds of plants!

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

The Ljungstrom air preheater has proved its value in industrial and utility plants throughout the country. That is why every year a constantly increasing percentage of the installed boiler capacity is equipped with Ljungstrom air preheaters.

Your fuel costs will be lower too, when your boiler is equipped with the Ljungstrom air preheater. The regenerative design of the Ljungstrom permits reliable operation at low exit gas temperatures. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.

If you are planning a new installation, or expanding your present one, our engineers will welcome the opportunity to show you how the Ljungstrom air preheater can raise the overall efficiency of *your* plant.



THE AIR PREHEATER CORPORATION

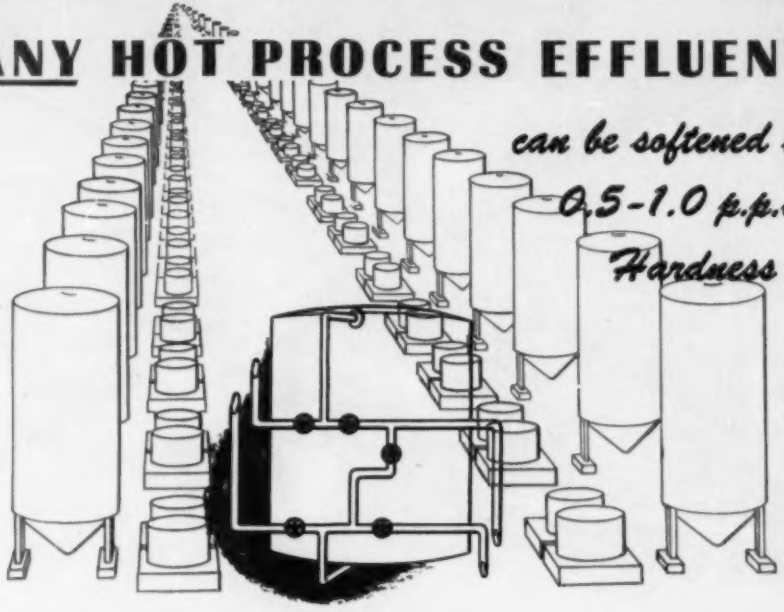
60 East 42nd Street, New York 17, N. Y.

ANY HOT PROCESS EFFLUENT

can be softened to

0.5-1.0 p.p.m.

Hardness



THESE WIDELY VARYING WATERS CAN ALL BE TREATED BY HOT LIME-ZEOLITE PROCESS*

(Using Nalcite HCR)

	A	B	C	D	E	F	G
Hardness as $CaCO_3$ (p.p.m.)	128	27	247	143	300	167	406
Ca as $CaCO_3$ (p.p.m.)	87	18	152	139	100	110	258
Mg as $CaCO_3$ (p.p.m.)	41	9	93	24	100	57	147
"P" as $CaCO_3$ (p.p.m.)	0	0	0	0	0	0	0
"M" as $CaCO_3$ (p.p.m.)	1	12	157	144	121	139	296
Cl and SO_4 as $CaCO_3$ (p.p.m.)	171	25	81	27	104	41	132
Fe as Fe (p.p.m.)	12			2	3		
SiO_2 as SiO_2 (p.p.m.)	5	10	26	22	58	3	15
pH	4.4				7.5	8.3	

* All these waters can be softened to less than 1.0 p.p.m. hardness.

Technical Data on Nalcite HCR

Nalcite HCR is a high-capacity styrene type cation exchange resin, with full exchange capacity at temperatures up to 250°F. This new technical bulletin, No. 58, gives you complete information on all advantages of Nalcite HCR. Write for your copy... free upon request.

with

Nalcite HCR

(HOT LIME-ZEOLITE PROCESS)

WATER softening with hot lime-zeolite (using Nalcite HCR) comes close to the ideal of plant operators in need of "zero" hardness water in large quantities . . . either for boiler feedwater make-up, or process use.

The ion exchange softener, employing Nalcite HCR, installed following any hot lime primary unit makes for simplicity of the entire process design and operation. No complex control procedures are required, thus making the process inherently trouble-free.

Where "difficult" raw waters have made other softening methods impractical, a check on the table at left will show that virtually any raw water can be—and is being—treated successfully and economically with this process.

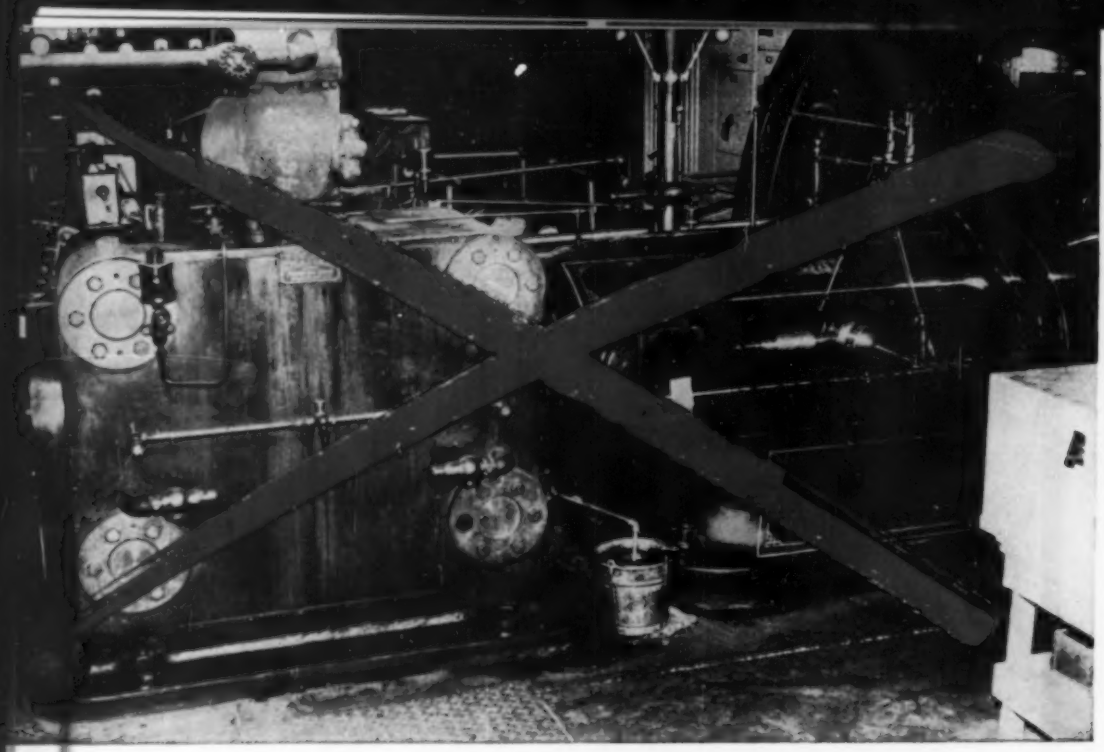
For full details on Nalcite HCR write Nalco or contact your Nalco Representative today.

NATIONAL ALUMINATE CORPORATION

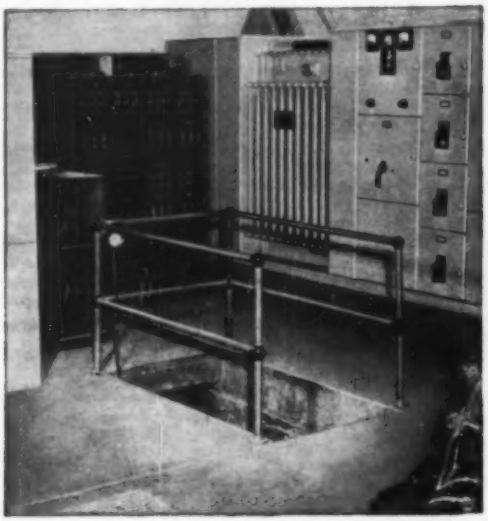
6216 West 66th Place • Chicago 38, Illinois

In Canada: Alchem Limited, Burlington, Ontario

A *Nalco*® **PRODUCT...** *When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.*



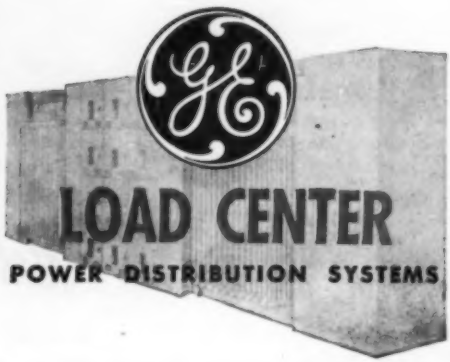
Obsolete power supply completely

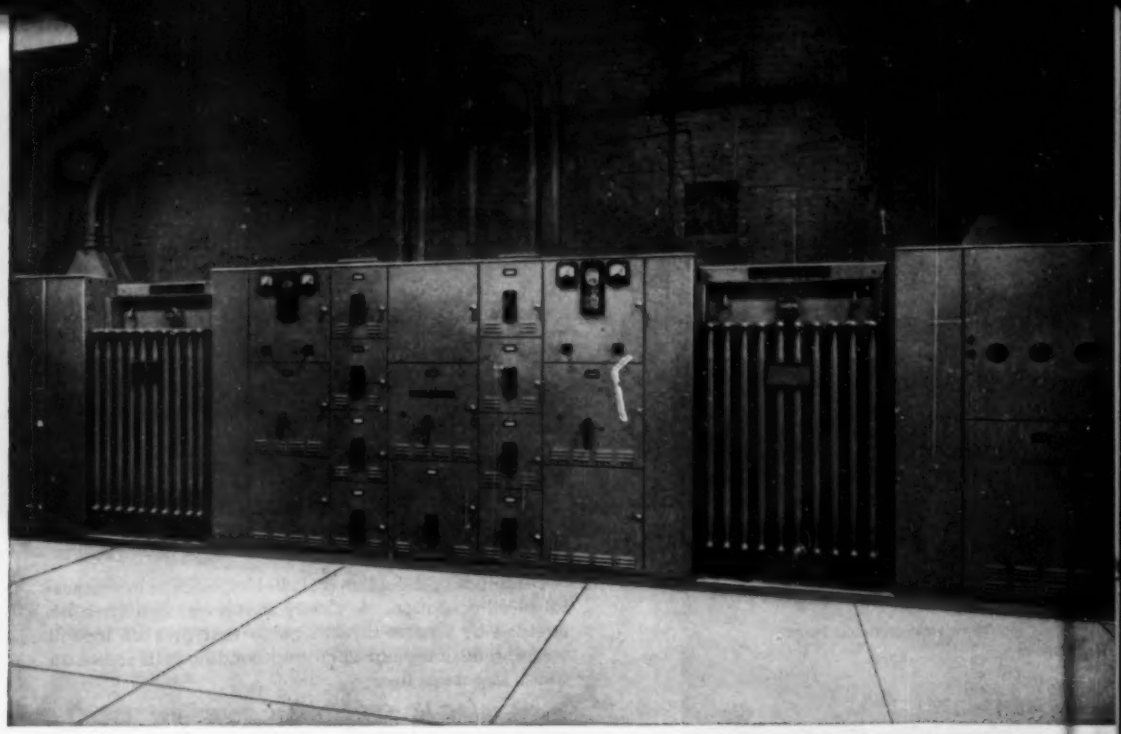


G-E LOAD CENTER UNIT SUBSTATION was installed without interruption of the plant's power. Sectionalized design permitted the two-step operation in which the generator's load was thrown on one transformer before the steam engine and generator were removed.

THE STEAM-DRIVEN GENERATOR pictured above supplied much of the power used by the Illinois Cabinet Company. Rated at 500 kva, it was severely overloaded much of the time. Failures of steam, engine and generator resulted in costly shutdowns.

The company could have saved $9500 in power costs if it had been purchasing the power it generated in 1947 and 1948. In addition, it would have avoided the expense of handling 56 carloads of coal.





replaced without plant shutdown!

G-E load center system saves Illinois Cabinet Company $4500 annually—simplifies future expansion

Plagued by costly power failures and poor voltage conditions, the Illinois Cabinet Company, Rockford, Illinois, called in the General Electric Company for a complete remodeling of its power system.

In place of the old 500-kva, 240-v steam-driven generator, G-E engineers suggested a 1000-kva load center unit substation and the purchase of *all power from the local utility.* In addition, they proposed a new feeder system to simplify the existing circuits, reducing voltage drop and copper losses. Calculations showed that power costs could be cut by $4500 annually.

To minimize lost production time, the double-ended load-center unit was installed in two sections since it could not be completely assembled until the old steam engine was removed. After the first section was installed, the generator's load was thrown on the new transformer. Then the steam engine and generator were removed and the second section was fitted into place. In two week-ends the transformation was complete.

You, too, can get a power distribution system adapted to today's constantly changing production picture. See your G-E sales representative, or write for Bulletin GEA-3592 Load Center Unit Substations and GEA-5600 "Electric Power for Industry's Third and Biggest Expansion." General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

121-79

Protect the plant and

with CROUSE-HINDS

. . . . . bells, horns, sirens, and visual signals

The most complete line

Raintight signals for non-hazardous locations

Type WH Raintight Horn with Grill

Type WH Raintight Horn with Single Projector

Type WH Raintight Horn with Double Projector

Type FS Raintight Pilot Light Condulet

Continuous production is of vital importance in successful plant operation. Costly shutdowns can often be avoided by Crouse-Hinds signals that give an instant warning of abnormal operating conditions or sound an alarm in case of fire.

A wide variety of signals is necessary to meet the varied conditions in industry. Crouse-Hinds offers a comprehensive line of signaling devices for plant protection and communication . . . . . sirens, horn, bells, and visual signals. Each unit is designed with individual characteristics that make it superior for a particular kind of service. There are Crouse-Hinds signals for use in non-hazardous locations; raintight signals for use where exposed to the weather; explosion-proof and dust-tight signals for use in hazardous locations; signals with a low volume of sound and high power signals that are extremely loud.

You have a definite advantage in selecting signals from the all-inclusive Crouse-Hinds line. It is possible for you to meet the requirements of every location. In noisy areas the character of the noise is of first importance. A signal producing a sound having the greatest contrast to the area noise should always be selected. For example, a horn would not be suitable in

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — Portland, Ore. San Francisco — Seattle — St. Louis — Washington. *Resident Representatives:* Albany Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va.
CROUSE-HINDS COMPANY OF CANADA, LTD., TORONTO, ONT.

CONDULET
First in the field
STANDARD OF QUALITY

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

maintain continuous production

Signaling Devices

for control of operations, and fire protection.

of explosion-proof and dust-tight signals for hazardous locations

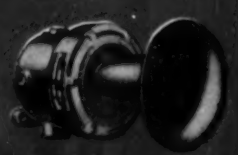
surroundings where a constant hum or whine is present but a bell could readily be heard. A bell would be inadequate in surroundings where the noise is produced by hammering on metal but a horn would give the required contrast.

Careful consideration should also be given to the number of signals required. In general, much better coverage is obtained by even distribution of several low output units than by one or two high output units. On the other hand, a high powered unit is necessary when the sound must be projected a considerable distance from one location.

Crouse-Hinds' line of visual signals includes a variety of pilot lights and also the Visularm, a compact unit used to supervise manufacturing processes. The Visularm will automatically indicate normal and abnormal temperature, liquid level, speed, load, or any other condition which can be electrically coupled to the circuit. An independent circuit is provided in the Visularm to actuate an audible signal.

In Crouse-Hinds' complete line there are dozens of different units from which to choose the items to meet your particular requirements. They are all listed in the Crouse-Hinds Condulet Catalog.

Type ETH Explosion-Proof Reseating Horn

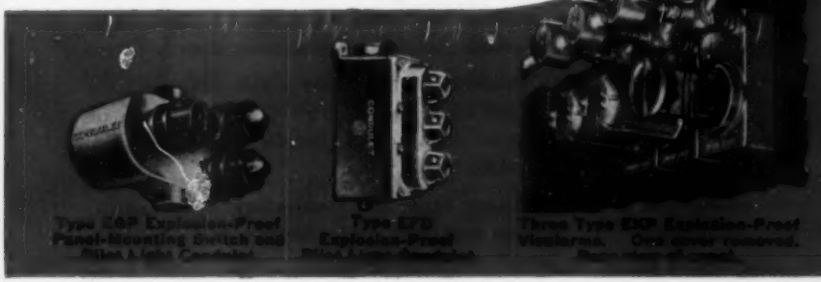


Type ETH Explosion-Proof Standard Volume Horn

Type ETH Explosion-Proof Siren

Type ETH Explosion-Proof High Power Horn with Grill

Type ETH Explosion-Proof High Power Horn with Flexible Projector

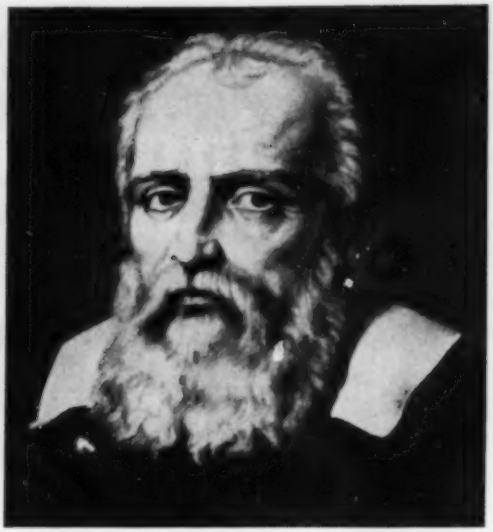


Type EAP Explosion-Proof Panel-Mounting Switch and Pilot Light Condulet

Type EFD Explosion-Proof Pilot Light Condulet

Three Type EXP Explosion-Proof Visularms. One cover removed.

Type EAR Explosion-Proof



How many do

Whether you recognize the first three faces or not, we think you'll know the fourth one. There are thousands of these Taylor FULSCOPE* Controllers in service today, in almost every process industry from chemicals to milk, from petroleum to plastics.

A Taylor FULSCOPE Controller is a rugged, dependable air-operated instrument for control of temperature, pressure, flow, liquid level, density, load and humidity. It was the first controller on the market with completely interchangeable unit construction.

All parts are interchangeable, and every FULSCOPE case is drilled and tapped to hold the most complete set of control responses. Simple controllers can be converted into the most complex, if necessary, right in the field; repairs can be made quickly by your own instrument man.

*Reg. Trade-Mark

The six standard types of FULSCOPE Controllers fit almost any processing need:

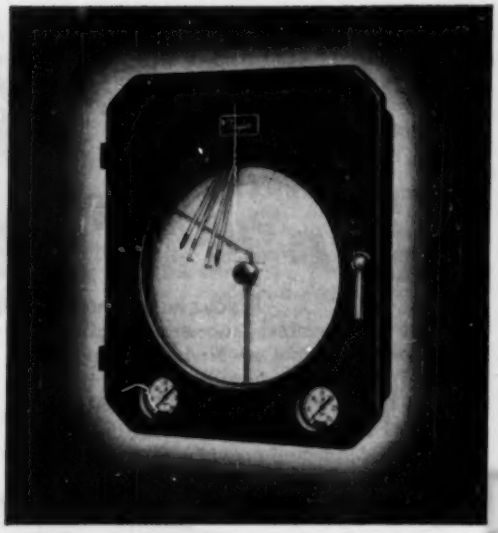
1. For simple on-off control on applications with small time lags and large capacities, regardless of load change, buy a *Fixed High Sensitivity* model.

2. For throttling control on similar applications, you need *Adjustable Limited Range Sensitivity.*

3. Throttling control where you have a wide range of time lags and capacities, infrequent or negligible load changes, calls for *Full Range Adjustable Sensitivity.*

4. Precision control under a wide range of time lags and capacities, with gradual, sustained load changes, calls for *Adjustable Sensitivity with Automatic Reset.*

5. Where there are momentary disturbances, but no sustained load changes, get *Adjustable Sensitivity with Pre-Act.*



you recognize?

6. To meet almost any control problem, get the FULSCOPE Controller with all three control effects: *Adjustable Sensitivity*, *Pre-Act* and *Automatic Reset*. It gives precision control on applications with a wide range of time lags and capacities, and sudden, sustained load changes.

Ask your Taylor Field Engineer how FULSCOPE Controllers can help solve a big majority of your control problems, protect product quality and save money too. Write for Bulletin 98151.

Where pneumatic transmission is preferred, and particularly where graphic panels are wanted, ask about Taylor's revolutionary new three-part TRANSET® Control System too. Write for Bulletin 98097. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.*

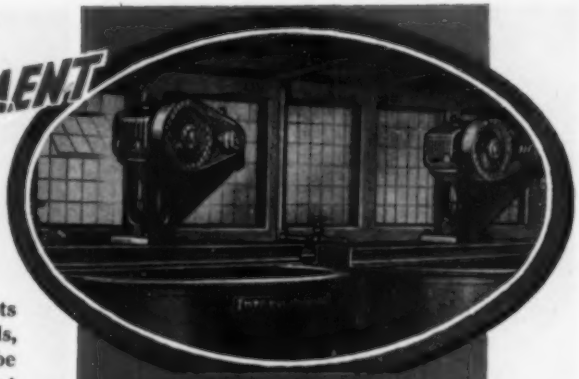
Still wondering who the men are? All are founding fathers of the instrument industry. First on the left above is Torricelli, who made the first barometer. Next is Galileo, maker of the first thermometer, and then comes Boyle, who discovered Boyle's Law. The face on the right, of course, is the famous Taylor FULSCOPE Controller. It is found in practically every process industry.

Taylor's Centennial
ACCURACY FIRST SINCE 1851

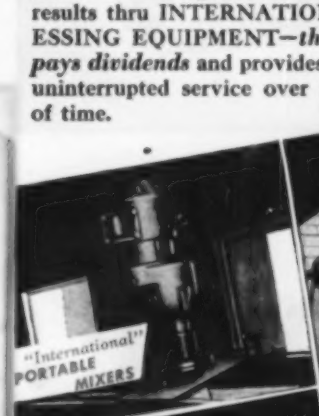
Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

"International"

THE RIGHT EQUIPMENT For Every PROCESSING JOB



If your requirements include the Chemical Processing of solids, semi-solids or liquid materials, you can be sure of volume production and exacting results thru INTERNATIONAL PROCESSING EQUIPMENT—*the kind that pays dividends* and provides dependable, uninterrupted service over long periods of time.



Bring your MIXING, BLENDING, TREATING and GRINDING problems to "International" for prompt and friendly cooperation. Many leading manufacturers and processors in the Paint, Enameling, Drug, Petroleum, Distilling, Ceramic and Chemical lines have found the experience and manufacturing facilities of International Engineering, Inc., to be of invaluable assistance in this highly specialized field. Write for Catalogs and full information.

International
ENGINEERING, INC.

NEW YORK CHICAGO

MFRS. OF CHEMICAL PROCESSING EQUIPMENT, VENTILATING FANS, STACK FANS, AXIAL BLOWERS, BRICK, TILE, POTTERY AND CERAMIC MACHINERY

Memo from the Editor **John R. Callaham**

What's in Store for 1952

- **Some 1,400 pages or more of editorial material.**
- **Four special issues and eight feature reports.**
- **More news on processes, technology and equipment.**
- **New and usable data on materials of construction.**
- **Other changes to fit CE better to your needs.**

Now that another year has rolled around, you might like to hear about some of the things we plan to do during 1952. You've cooperated in letting us know what you want; here's what we're doing about it now.

• **1,400 Pages**—Next year we'll bring you 1,400 pages or more of editorial material. That will be an increase over 1951.

More important, though, than the number of pages is what's on them. Here we'll keep on doing two things to make every page carry a bigger payoff: put in the right kind of information, boil it down—and keep it that way.

Most of you have already noticed (and liked) our efforts to "keep it short." So, during 1952 I'm sure you'll find more ideas and information than ever in those 1,400 pages or more of articles, editorials, feature reports, special issues, technical and news departments and pictured flowsheets.

• **Special Issues and Reports**—We plan to give you four special issues next year. Each will have from 32 to 48 pages on a specific subject.

Our first one will be in February, when we'll take a broad look at what happened this year and how these events may well shape the trend of things to come. We'll cover such topics as plants and facilities, processes and technology, mobilization, labor and manpower, supply and demand, profit and loss, law and government.

These February reports usually hit the jackpot in reader interest. But this time something new will be added on advances in technology; it should have permanent reference value.

Most of you, too, can look forward to our May issue. This time we'll take up to 48 pages to do a special job on instrumentation: recent advances and trends in this important field of engineering.

In July, we'll do something big to celebrate our 50th anniversary as a chemical engineering publication. Maybe something along the line of "Chemical Engineering's First 50 Years"—and a few of the things we expect to be reporting during the next fifty!

Then, come November, we'll put out another big materials of construction issue. We've already started to work on an approach that'll be entirely different from anything we've yet tackled. The slant is one you've asked us to cover.

Next year's feature reports will hit hard on the themes of unit operations, unit processes, equipment roundups and industry trends.

In January, for example, we'll tackle the sulphur situation and round up information on the economics of alternate sources. A little later we plan to give you a special report on pumps for chemical processing plants, then on size reduction, adsorption and feeding devices.

• **Process News**—One of our recent changes has been to include "featurettes" on new and newsworthy processes in our regular Chemical Engineering News department. This is a brand new approach to news; it is an approach that has already attracted a lot of attention throughout industry.

Now we plan to give you better and broader coverage of newsworthy developments in chemical processes, production techniques, technological trends, engineering research, plants and facilities and equipment.

These "timely technology" featurettes, as one New York engineer has tagged them, are all aimed at giving you a terse, fast-moving roundup on the month's newsworthy technical developments, why they're important and briefly how they work.

If you're interested in new processes and technology advances, you'll find more news about them during 1952 in our Chemical Engineering News department.

• **New Data on Materials**—In this month's Corrosion Forum (p. 268) we're presenting corrosion data in an entirely new form. We believe it's a form that'll make it much easier to use and more valuable as permanent reference material.

We have been collecting data and working out the new system for about a year; now we're able to start feeding you a regular stream of new data in plotted form. Each month we'll cover a different material of construction.

Data shown in the plots, by the way, comes directly to us from the leading manufacturers in the materials of construction field. The job we've mapped out to do would be impossible without this cooperation from members of the industry.

Several prominent corrosion engineers have told us that two or three years from now, when the series will be about completed, our data will be recognized as the most complete, up-to-date, concise and usable ever published in a chemical journal. That's certainly our objective.

We'll also keep up next year another "plus" we've just made in Corrosion Forum. This is a short section that gives you news and timely technical information on developments in the field (see p. 286).

• **Other Changes**—There'll be other changes, too. Some will be made in January, others later in the year.

There'll be, for instance, more timely news on chemical products. Little roundups that'll tell briefly what's happening to some newsworthy chemical product introduced in recent years. This broadened coverage will be reflected in Product News, the new name for our New Products & Materials department.

Two of our departments—News from Abroad and Commodity Survey—will be dropped. Instead, we'll cover important developments in these two fields in our expanded Chemical Engineering News department. This move will help us make our coverage more selective, more timely and more useful.

We're making all the changes I've mentioned here (and others that I haven't) for one big reason: our reader research and personal contacts with you have made it clear that you want them.

I am confident that during 1952 you'll find Chemical Engineering a better, more useful and more timely publication. Your tips and your help have made this possible. I appreciate them.

Life-saver for Users of Nickel-Bearing Steels

If you are among those handicapped by government restrictions on nickel-bearing 18-8 stainless, large Ryerson stocks of straight chrome stainless may prove to be a life-saver. For example, many who formerly used type 302 sheets to meet mild corrosive action are finding a practical alternate in type 430. And this 17% chrome stainless is on hand now —ready for immediate delivery from your nearby Ryerson plant.

You can order type 430 sheets from Ryerson in all gauges from 10 to 26, in No. 2B or No. 4 finish—and in almost any quantity. You can also get quick shipment of these additional straight-chrome products: type 405 sheets—types 410 and 430 plates—and type 416 bars. It all adds up to the nation's largest stock of straight-chrome stainless. All with no restrictions on end use, but all time-tested Allegheny stainless of uniform high quality and definitely established characteristics.

In this stock, you may well find a steel that will enable you to maintain satisfactory quality in your product until nickel-bearing steels are again available. So now for stainless, we urge you to consider the versatile chromium stainless steels in Ryerson stock.

RYERSON CERTIFIED STEELS

WRITE FOR HELPFUL DATA—*On Type 430 and Other Chrome Stainless*

To help you convert to chrome stainless, we shall be glad to send an authoritative bulletin on the mechanical properties, corrosion resistance, weldability, etc., of these steels as compared with 18-8 stainless. Write for your copy. And remember that the advice of Ryerson stainless specialists is always yours for the asking. We suggest you discuss your chrome stainless problems with us.

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SIDNEY D. KIRKPATRICK, Editorial Director JOHN R. CALLAHAM, Editor

Chemical Engineering
WITH CHEMICAL & METALLURGICAL ENGINEERING

DECEMBER 1951

Conditions Favorable—and Otherwise

No man in America can speak with more authority than Dr. Karl T. Compton on the contributions of research to the prosperity of our people and the security of our nation. His wartime role in directing many defense research agencies, his association with Baruch and Conant in establishing the synthetic rubber program, his subsequent service as the chairman of the Research and Development Board of the Department of Defense, and his recent championing of Universal Military Training as a member of the National Security Training Commission, all these have combined to give him an abiding faith in the processes of technological achievement. But that experience has also taught him to recognize the problems to be faced by management and government if the public is to have the benefits which research and development are capable of creating for it in the future.

It was with these requirements in mind that Dr. Compton addressed the Eleventh Chemical Engineering Award dinner on "Conditions Favorable for Technological Achievement." And because his approach was eminently practical he chose to discuss conditions that hamper as well as those that promote the accomplishments that are so basic to our national welfare.

First and most pressing is the manpower problem, which we know will become increasingly serious during the next three years. "To meet this situation as best we can in the near future," advised Dr. Compton, "we must (1) utilize the men we now have, who have engineering training and ability, in positions where their engineering talents are needed (*Military Departments and Selective Service please bear this in mind*) and, (2) specifically train and upgrade promising subordinate personnel to back up trained engineers so that they can concentrate on the most important jobs." For the longer pull, we must strengthen our engineering schools and encourage many more promising young men to embark on engineering careers.

Second is the need for new facilities—laboratories with most modern equipment for research and test. Here the former director of RDB drew on his personal experience to sound a warning against the present trend toward building huge governmental installations to handle military research. Unnecessary duplication of defense research facilities is wasteful and inefficient. Sooner or later it will lose to the government the scientific talent and facilities of private enterprise, destroy the intimate relations with industrial and university laboratories "which have taken us so long to establish and which are among our greatest 'quick assets' in time of emergency." For the public's own good we must do all we can to discourage this burgeoning bureaucracy now being built up in the name of national defense. The best way for industry to do this is to show its willingness to contract for more and more military projects even though they do disrupt our normal business programs.

Lastly Dr. Compton lumped a great group of climatic conditions under the single head—Environment. By this he meant such factors as "incentive, opportunity, reward, prestige, regulation and tax policy which stimulate and encourage new technological developments, or discourage them." Again his plea was for the system that promotes the ambition and enterprise of free individuals. Again there was warning of governmental subsidies which stifle initiative, perpetuate technological obsolescence. And almost equally damaging to a healthy environment for technological achievement is the present tax structure—the high excess profit taxes that serve as a deterrent to "exactly the type of industrial growth which is most desirable—that aimed at new products, added employment and new sources of profits (and of taxes)."

Such are some of the problems for which wise handling by management, government and the public, as well, is essential if this country is to obtain a full measure of progress through scientific research and engineering developments. As chemical engineers, and as citizens as well, we have important responsibilities in helping create more favorable conditions for technological achievement.

Sidney D. Kirkpatrick

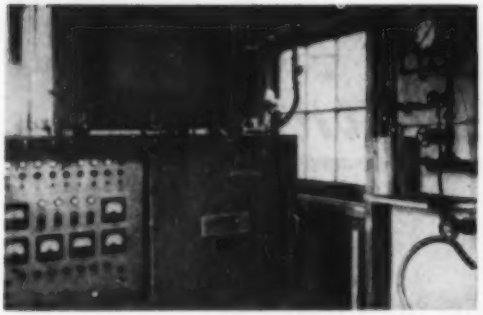


Fig. 1—Continuous monitoring mass spectrometer and its recorder are installed in vapor-tight housings under inert gas.

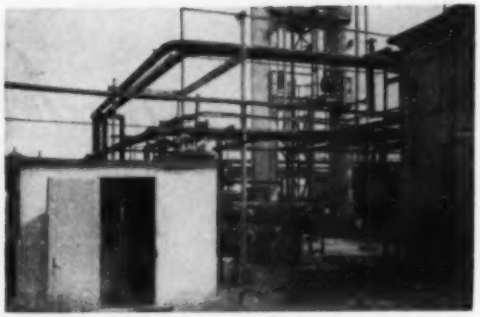


Fig. 2—Tests on the spectrometer were conducted in this shed at the Socony-Vacuum Paulsboro, N. J., refinery.

Process Control by Mass Spectrometer

Mass spectrometers modified for the continuous monitoring of complex gas mixtures are now stepping from the laboratory into the plant.

CHARLES F. ROBINSON

Tests recently conducted on the continuous monitoring of a complex plant stream by means of a mass spectrometer have shown an important time advantage compared with usual practice. Where conventional periodic sampling-analytical procedures are used, as much as 24 hr. can elapse before deviations from the required composition become known.

In many applications the mass spectrometer has become known as an analytical tool of unequalled speed and accuracy, capable of handling complex mixtures not readily analyzed by other techniques. However, mass spectrometers have been complicated and expensive, and have required the services of a specialist for operation and interpretation of results. But pressing needs of the atomic energy program have led to the adaptation of the mass spectrometer as a monitor for continuous processes, and it is now becoming apparent that such continuous process monitoring is valuable in many applications where complex plant streams are involved.

This means, from a practical standpoint, that direct monitoring in a continuous process can provide a very effective method of composition control, indicating changes in a complex mixture in a matter of minutes.

The tests in question were conducted at the Paulsboro, N. J., refinery of the Socony-Vacuum Oil Co., where a specially designed process-monitoring mass spectrometer was installed on a trial basis. Produced by the Consolidated Engineering Corp., the spectrometer (Fig. 1) is in a vapor-tight housing—as is the Brown Electronik recorder—and is completely maintained under an inert atmosphere, dry air, etc., to eliminate fire hazards. The apparatus is designed to analyze a flowing sample stream continuously and automatically. In several months of operation the equipment has proved an effective means for rapid reporting of accurate composition.

For the trial period, a sampling point was selected that would facilitate checking the practical effectiveness of continuous monitoring of a relatively complex plant stream. The point selected was the bottoms stream from a de-ethanizer distillation column at the No. 1 gas plant. The test data obtained constituted an accurate, continuous analysis of the actual ethane concentration in the bottoms over a period of several months. Precise quantitative determinations of small amounts of ethane in such a stream impose rather severe requirements even for this method of analysis.

Check on Accuracy of Monitor Instrument
(Figures are mole percent ethane)

Continuous Monitor	Laboratory Mass Spectrometer	
	Gas Phase Sample	Liquid Sample
0.3	0.3	0.2
0.3	0.2	0.3
0.5	0.4	0.5
0.5	0.6	0.6
0.7	0.8	0.9
0.7	0.5	0.8
0.7	0.8	0.8
0.7	0.6	0.5
0.8	0.9	1.0
0.8	0.8	0.9
1.1	1.2	1.2
1.4	1.5	1.4
1.6	1.6	1.6

SAMPLING PROCEDURE

The monitoring spectrometer is situated in a small shed adjacent to the distillation column, as illustrated in Fig. 2.

Referring to the diagram, Fig. 3, a representative sample of the bottoms stream is obtained continuously from a rapid flow of the liquids stream piped through a ¾-in. line running past the shed. Rapid flow is assured as a result of the high pressure drop between the reboiler (500 psi.) and the caustic treaters (225 psi.).

In operation, block valve *A* is opened fully to admit full pressure of the liquid to needle valve *B*. When the needle valve is opened, it releases the sample to pressure slightly above atmospheric and gasification occurs. The needle valve is heated by low-pressure steam to prevent freezing.

The needle valve is opened sufficiently to give a steady flow of gas (indicated by the oil bubbler) through ¼-in. aluminum lines to the spectrometer. A gas flow of a few liters per minute is maintained in order to provide rapid flushing of the lines and

CHARLES F. ROBINSON *is a member of the research department of Consolidated Engineering Corp., Pasadena 4, Calif.*

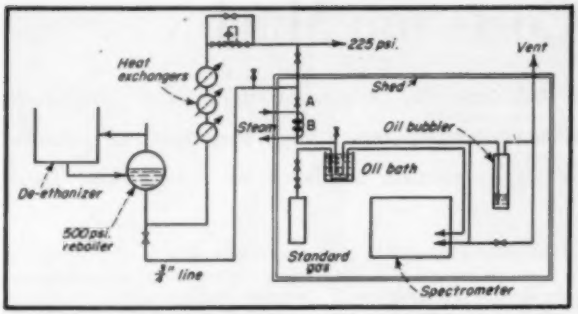


Fig. 3—Schematic diagram shows how the sample gas and gas used for standardizing are supplied to the spectrometer.

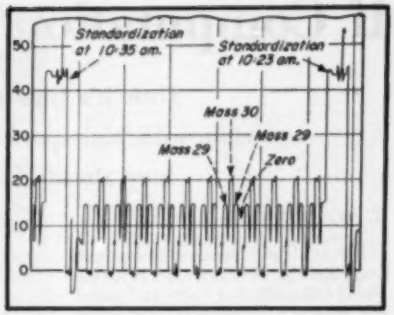


Fig. 5—Typical record of ethane content shows also automatic standardization.

short response time; however, nearly all of this gas is vented to atmosphere. This sample consumption could be greatly reduced, if desired, by refinements in the sampling arrangement since the sample demand of the mass spectrometer itself is only 0.4 cc. per minute. Both the sample under analysis and the standard gas used by the spectrometer for self-standardization pass through coils of copper tubing, soldered together and immersed in an oil bath. In this way, equality of temperature is obtained for the two gases transmitted to the spectrometer.

Both gases are delivered to the spectrometer at pressures of approximately 1 in. of water above atmospheric. These pressures are obtained by passing the sample gas through the oil bubbler, and the standardizing gas through a low-pressure regulator. The net result is to supply both sampling and reference gases to the spectrometer at equal pressure and temperature.

The mass spectrometer designed for the continuous analysis of a process stream differs from an instrument intended for general analytical work in a laboratory in two essential respects. First, the monitoring type instrument proceeds analytically in a step-wise fashion from one to the next of a limited number of preselected mass peaks, rather than by continuous scanning of a relatively extended region of the mass spectrum, as in the laboratory type instrument.

Any number of mass peaks can be accommodated for analysis in step-wise order. However, the analysis should include only the minimum number of peaks necessary to show the required analytical data. This results in simplifying the chart record and its consequent interpretation, and in speeding the completion of the analytical cycle. In addition, it results in a reduction of the over-all cost of the apparatus.

The second essential difference in the monitoring type of instrument is the incorporation of self-standardization. This, accomplished automatically against a gas of constant composition, maintains the highest degree of accuracy by compensating for small changes in sensitivity. The self-standardizing system incorporates a single Brown servo amplifier and four Brown servo motors and is so arranged that each mass peak can be recorded at a different sensitivity from the remaining peaks. This further simplifies the chart record and subsequent interpretation.

The general arrangement of the mass spectrometer and its sampling lines is represented in Fig. 4. In operation, the sample is conducted to the sample control valve through a line constructed to give the desired response time. By viscous flow, the sample passes through the primary leak and into the sample manifold. Approximately 99 percent of the sample flows from the manifold and out through the case vent.

The molecular leak, through which the remainder of the sample flows, is constructed so that the gas flow through it is essentially molecular in nature. This gas passes into the ion source, as shown, and is ionized in the conventional manner by an electron beam. Ion acceleration, separation at the ion collector and measurement and recording of the resolved beam are also basically conventional.

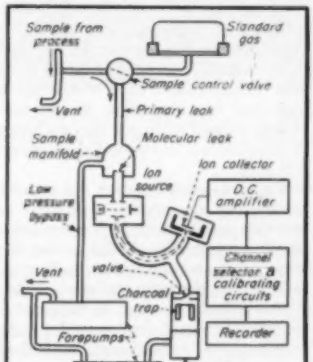


Fig. 4—Diagram shows general arrangement of spectrometer and sample lines.

A typical chart record obtained during the de-ethanizer test is shown in Fig. 5. The mass spectrometer is adjusted so that ethane concentrations are determined by noting the difference in chart divisions between the mass 29 and mass 30 ion peaks. Each division represents 0.2 mole percent ethane.* As only two of the three available mass-scanning channels of the particular instrument are required for ethane analysis, the third channel is used to repeat the mass 29 scan and thereby check reproducibility.

The speed of response of the sampling system was checked by purposely upsetting the temperature of the de-ethanizer bottoms by 10 deg. F. An interval of 6 min. elapsed from the time of upset to the first indication of change in ethane concentration. Since the instrument response time to a change in the composition of the gas delivered to its lines is about 20 sec., the remainder of the delay is attributable to sluggishness of temperature control, and or hold-up in the sampling lines. In any case, the speed of response

(Continued on page 141)

* The reason for this method of adjustment may be explained briefly as follows: Mass 29 is a characteristically strong peak for many hydrocarbons. This is the C_2H_5 fragment. A certain number of these fragments, 2.2 percent on the average, will contain the isotope C^{13} and so be of mass 30. Therefore, a mixture which shows more than 2.2 percent mass 30 will indicate the presence of ethane. In the spectrometer the channels for mass 29 and mass 30 are adjusted to different sensitivities so that with an ethane-free sample the two peaks will be of equal height. Hence, any excess of the mass 30 peak over the mass 29 peak gives a quantitative measure of small concentrations of ethane. Different arrangements would be used for higher ethane content, say, of the order of 10 percent.

If Computation Costs too Much . . .

Then it's time to look into the savings in engineering calculations possible with high-speed office-type computers. Your accounting department may already have an installation available on a part time basis.

J. W. DONNELL

NOTE—*In our report on Computers a year ago (pp. 117–130, Dec. 1950) we stated editorially that "New and useful engineering applications [of high-speed automatic computers] will take time to develop. This is true partly because the developments in high-speed automatic computation are largely new. It is true too because there has until recently been little meeting of minds between the developers of computers on the one hand, and potential engineering users on the other."*

Professor Donnell is one of several engineers in the schools, as well as in chemical industry, who have accepted the challenge to demonstrate what such computers can do for the chemical industry and the chemical engineering profession. In the computation laboratory at Michigan State College he has been showing how some of the most laborious aspects of chemical engineering design can be mechanized, to free engineers for more productive thinking. Here he deals with ideas, however, rather than computation techniques.

Meanwhile, the builders of high-speed office computing machinery have themselves been going ahead rapidly in engineering applications, and now stand ready to help potential users in studying advantages and methods of applying such equipment to engineering department problems. IBM, for example, now has a staff of 35 specialists for just this purpose.—EDITORS.

Chemical engineering knowledge is expanding rapidly which means that more and more calculation is becoming necessary, while calculations are also becoming more complex. In the meantime, competent chemical engineers who can perform complicated calculations rapidly and accurately are scarce and expensive. High-speed mechanical and electronic aids to calculation are necessary if process industries are going to make the fullest possible use of the abilities of these engineers.

As engineering offices are operated today, much of the chemical engineer's time is cluttered up with repeated calculations for such well-known unit operations as distillation, absorption, and fluid flow. But we are beginning to learn that the new standard high-speed accounting and computing machinery can readily be adapted for such purposes. The time is passing when the average chemical company will use ordinary desk calculators for its accounting procedures. Many companies are acquiring high-speed computers for accounting department use. Although accounting problems are different from those of the engineering office, they are generally not simple. As proof of the value of high-speed computing equipment, we should note that the accountants are now able to justify machinery rental costs as high as $25,000 per year for even a small accounting office.

Similarly, I believe the day is coming when engineering offices in the process field will have their own high-speed automatic computers. Meanwhile, there is often such equipment in the accounting department which is used for only 8 hr. or so per day. This means that it should be available to the engineers for another 16 hr., and so give them an opportunity to learn how to systematize their computation problems for adaptation to the machines, as well as to put the machines to practical use in easing the engineering load.

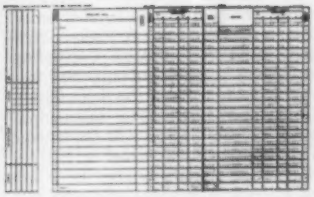
The difference between our present method of engineering computation and that possible with high-speed automatic computers is similar to the difference between the custom-built automobile, and the mass-produced model. Today nobody attempts to build automobiles by hand for general public consumption, even though individual needs could be met better in that way. And yet we custom-build our computations. Each problem is individually treated as it arises. This makes for waste and expense and is subject to inaccuracies when speed is required, or where engineers of immature judgment must be used.

It would be much simpler if the desired calculation could be fed into a high-speed computing machine, or obtained from data tables previously prepared by high-speed computers. To do so would save much time, insure accuracy, and enable many more calculations to be carried out. This last point is particularly important in permitting us to arrive at the most economical solution to any particular engineering problem.

There are two principal ways in which engineering offices can make the most effective use of high-speed computing machinery. Every engineering office frequently experiences periods between large projects when the engineering personnel is not working at capacity. At other times, however, the personnel may well be overtaxed. The first method of using computers, therefore, is to employ the slack periods for developing data tables which can later be of tremendous value in ironing out the work load peaks during the active periods. On the other hand, tables of this sort would not be able to take care of every sort of calculation, leaving the second type of computer application, namely, use for the solution of individual problems.

Take a specific example of the first type, the development of data tables. The computing machines for office use available today are of the mass operation type, most useful when making a great number of similar calculations at one sitting. This characteristic makes them particularly useful in the development of tabular material. A typical case would be the calculation of a considerable number of distillate compositions as a function of feed composition, pressure, trays, and reflux. Once such a table was developed, if the office were called on to design a gasoline-recovery plant consisting of distilling towers such as depropanizers, debutanizers, butane splitters, etc., then a quick glance through the tables would tell not only the number of trays to use for a given reflux, but the number of trays for

J. W. DONNELL, *professor of chemical engineering at Michigan State College, East Lansing, Mich., and author of several recent articles on distillation calculations, has been devoting a great deal of attention to the use of high-speed computers in a variety of engineering calculations.*



If your engineers are bogging down in design calculations, high-speed computers may be the answer. The problem is reduced to arithmetic on a planning chart . . .

other refluxes as well. Thus an economical balance between plates and refluxes could be worked out quickly and with confidence in the accuracy of the result.

Those unfamiliar with high-speed computing machinery may feel that such a table development must be tremendously costly in both time and labor. This is not the case, however, especially if idle accounting department machinery is available. These computers can multiply, add, divide, subtract and perform combinations of these operations at rates as high as 9,000 calculations per hour. They can print the results in tabular form and do so virtually without attendance, once the problem is properly set up.

With such tables computation is so speeded up that it becomes feasible to determine the most economical sizes of equipment. The case is similar to that of an automatic spectrograph. Rather than to regard this machine as a replacement for chemists, it should be regarded as a device which performs so many analyses that the company could not afford to hire as many chemists as would be needed to replace it. Furthermore, it makes analyses so cheaply that chemical control service can be extended many fold.

This question of economical size versus operating cost has become especially important in the face of today's changing fuel costs, labor, equipment expense and amortization rates. With automatic computers it becomes feasible to collect and work up into technical data books or operating standards many more statistics on operating data, cost and design from pilot plants or commercially operated plants. With such technical data books the process engineer would find his work on preliminary designs easier, more reliable and much quicker to carry out.

Photo courtesy St. Louis Post Dispatch

. . . then when the machines are set up, results print automatically as shown by this card-programmed electronic calculator in use by Monsanto Chemical Co.

In addition to precalculation via the tabulation route, computers will also find much use on individual problems. Although this is not as fast as using precalculated tables, it can be speeded by using a machine operator who can set up the problem quickly, once he has been given an algebraic formula. Another useful method is to keep a supply of machine-control plug boards which can be permanently wired for carrying out the principal unit operations calculations. This means, of course, that the engineers who use the machines must learn to set up problems by iteration or trial-and-error so as to use the full facilities of the machine. They must learn to schedule problems to avoid machine delay while engineering judgment or mental calculations are carried out. Having done so, however, they will be relieved of

many laborious calculations, thus having time for more productive mental effort.

SOME COMPUTER APPLICATIONS

In making high-speed computer computations economically, it is necessary to organize the calculations carefully to fit the available computing machinery. One important step has already been taken in the organization of chemical engineering calculations under the heading of unit operations. This is particularly useful in the development of data tables. As a few examples of high-speed computer use, both for table development and for individual computations, let us consider a few problems in fluid flow, heat flow, distillation, absorption, extraction, humidity and drying.

Fluid Flow—This first problem is somewhat more detailed than those to follow, in order to show what some of the possibilities and limitations of computing machines may be in practical application. Let us consider the problem of pressure drop through a once-through boiler or pipe still, where vaporization or chemical reaction (or both) takes place. In this case it is desired to find the size of pipe which will give the desired outlet temperature, with no more than a stated pressure drop. There are, of course, several different ways of adapting the problem to a computing machine, bearing in mind that such a machine can add, subtract, multiply and divide at a high rate of speed. One obvious way would be to divide the desired temperature rise into small increments. Starting with the allowable inlet pressure we would choose an assumed pipe size and solve for the pipe length and pressure drop corresponding to the small temperature increment. Then, using the new pressure (at the end of the first pipe length increment, corresponding to the first temperature increment), and the second temperature rise, we would obtain the second pipe length increment. This process would then be continued until the allowable pressure drop was all used up. If the required outlet temperature had not been attained, or had been passed, the calculation would be repeated using a new pipe diameter until the allowable pressure drop coincided with the required outlet temperature.

Without going into detail, in simplified form the algebraic formulas for each temperature increment furnished to the machine operator for this problem would be of the form:

$$\Delta L = KD^5 (T - \Delta t)/Q$$

$$\Delta p = K_1 \Delta L G^2/p$$

Some of the factors in these equations would be supplied to the machines as a function of one or two other variables. The necessary factors for the variables which are held constant over the small increment are quickly selected by an electronic sorter from a punched card file for the variable in question, which gives the factor as a function of the variable. When the sum of the incremental pressure drops, as added automatically by the machine, coincides with the total allowable pressure drop, then the proper diameter of pipe has been selected, provided the last temperature increment has been used. For each incremental calculation the data needed are available quickly from data stored in the machine from the previous calculations, or from the sorted cards already mentioned.

The calculation just described is of the specific problem type, rather than of the tabular type. A good example of the latter would be the compilation of tables giving pressure drops for various flow rates, pipe sizes, fluids and roughness factors. Such a table can be easily and completely prepared on computing and tabulating machines. The problem is much simpler than that of the pipe still, but is handled in much the same fashion. Only simple formulas are needed, requiring just one data card insertion for the friction factor as a function of the Reynolds number and roughness factor. Such a tabulation is particularly useful in correlating the roughness factor with pressure drop in the transmission of fluids over great distances, and also in the design of new lines. Pipe sizes and capacities can quickly be determined when the other flow variables are given.

Heat Flow—Certain types of tonnage oxygen plants use heat regenerators, and such regenerators are becoming more and more important. The heat regenerator furnishes a useful example of the application of computers to heat flow. Where the regenerator elements are simple and symmetrical, it is possible to arrive at concise mathematical solutions of the temperature gradients, but these involve long trial-and-error solutions, and usually require use of Fourier and Bessel functions. When the design is non-symmetrical, concise mathematical treatment is impossible. In any event, computers lend themselves to the stepwise method of calculation, by imagining the element divided into thin layers, and the time into discrete intervals. The temperature throughout any one thin layer is considered constant during the time interval and the heat flow is computed from layer to layer. In this way the temperature gradient can be computed readily as a function of time. Fairly simple algebraic formulas can be set up for the area of each layer, and for the heat flow from layer to layer which is merely a simple heat balance. Thus, simple arithmetic is involved, but this straightforward method requires a large amount of simple arithmetic, well suited to high-speed computers, but extremely tedious by ordinary methods.

An example of the use of computers in preparing heat transfer tables would be the case of water- or oil-quenching of metal parts, giving the temperature

What's in a Computing Laboratory?

Computing machinery here referred to is of the office machine type, rather than the extremely high-speed machines typified by such names as ENIAC, UNIVAC, SEAC and SSEC. High-speed office computing machinery is fast enough for most engineering use. Since such machines make use of punched cards, a computing laboratory contains not only computing machines, but also machines for punching, verifying, and reading punched cards, or printing their contents, and for manipulating cards in various ways such as counting, sorting, arranging, selecting, matching, comparing, and merging cards from two sources.

The computing machines are of four general types, varying in their versatility. Most types are able to distinguish signs and compare numbers on an "equals," "greater-than," or "less-than" basis. All types receive data via punched cards, and all but the last type receive instructions (i.e., are controlled) through use of prewired plug boards. Instructions come to the last type via punched cards, giving it greater versatility.

Tabulators: Print data, add, subtract, print sub-totals and totals.

Multiplying punches: Add, subtract, multiply, punch results.

Calculating punches: Add, subtract, multiply, divide, punch results, are automatically sequenced and may be either mechanical or electronic, the latter much faster.

Card-programmed electronic calculators: Add, subtract, multiply, divide, store data and intermediate results, print final results, and, if desired, record operations carried out.

Although these machines are capable only of performing arithmetic operations, they are readily employed in iteration and trial-and-error sequences and can determine roots and powers, functions of all kinds, and solve equations of higher mathematics.

gradient as a function of time. This is similar to the regenerator problem, but simpler since a uniform temperature exists at one part of the heat cycle. Such tables are clearly necessary, as evidenced by the preparation by Russell in 1936 of much abridged quench tables for plates and bars. Despite their briefness, Russell's tables[4] represent extensive calculation. They cannot be extended to other symmetrical shapes, much less to unsymmetrical ones. General application tables would require the use of high-speed computers.

Distillation—The petroleum industry has been using distillation in multicomponent systems for a long time, and such systems are now becoming important in the chemical field, as well. Designing towers for multi-component systems involves long, tedious calculation as well as a high degree of accuracy. A procedure recently described[2, 3] adapts present-day standard fast accounting computers to such calculations. The method gives both speed and accuracy. We should note that even though distillation tables were to be prepared, a set of prewired control boards would be necessary in offices using computing equipment for distillation design, to enable the many variations of distillation problems to be computed expediously.

Absorption—Just as computers are needed in distillation, they are needed in absorption design. The problems are rather similar, although a notable difference exists. Even though plate-to-plate calculations are involved in both, there is a variable overflow from plate to plate and the tower coolers in absorption which is not ordinarily involved in distillation towers. Work has already been carried out on the use of automatic computers in absorption calculations, which may be outlined as follows

For given values of the incoming gas composition, absorption medium rate, number of plates, and maximum allowable temperature rise, out-going gas composition and location of the gas coolers has been calculated. We have set up detailed instructions for non-technical machine operators to speed the calculations, so that only a minimum amount of engineering time is needed in starting the machine operator off on a specific absorption problem.

One absorption problem in the category of specific computer calculations is the design of so-called absorption-distillation towers. In this case, absorption takes place in the top portion of the tower and distillation in the lower part. Calculations for such towers are ordinarily very long and tedious, but are being encountered more frequently, since such a tower permits operation, say of a de-ethanizer, without resort to exceedingly low temperatures or high pressures. A combination of published procedures for using computers in distillation and in absorption should conquer this calculation bottleneck.

Extraction—Involved design calculations occur in extraction when applied to liquid processes using solvent reflux, with more than one solvent. Graphical solutions so far have given the best results, particularly when only one solvent is involved. But graphical solutions bring about inaccuracies unless very large charts are used, especially where there are many lines on the graph. Time, too, may be excessive, especially when it is necessary to find the final compositions from an extractor for a given number of stages.

Extraction calculations are all based on simple material balances. Therefore, high-speed computing machinery is well suited to this use. As a matter of fact, computers can be adapted to the actual graphical methods, since these make use of simple geometric principles. Here the electronic sorter is very advantageous in selecting the proper card as the calculation proceeds from stage to stage. Data cards can be selected from a file cross-indexed to take into consideration the equilibrium curves and corresponding tie lines or phase compositions, and the amount of reflux. Such procedure involves a minimum amount of calculator time, an advantage due to the sorter, which can sort some 39,000 cards per hour and is the fastest machine in the usual computing machine set-up.

For extraction calculations it would appear advisable to have a file of punched cards, giving the equilibrium relationship between phases for various solvent-reflux ratios. Such a file would enable extraction calculations to be solved readily and rapidly. It is evident that here is a combination of the two methods of precalculation and of calculation as the problem arises.

Humidity and Drying—Until recently humidity charts have been the principal means of relating the properties of air-liquid atmospheres. Now, however, we are using broader temperature ranges, from freeze drying to high temperatures, and we are using liquids other than water. Such charts are, therefore, proving inadequate. The computer-tabulator method offers an ideal solution for the quick preparation of tables for any temperature range and any gas-vapor atmosphere.

Rather lengthy trial-and-error calculations enter into cooling tower design, involving heat transfer, mass transfer, heat balance equations, and a humidity chart. The equations are not complicated, and it is possible to set up a trial-and-error calculation table[4] enabling the calculations to be performed mechanically. Computing machines would serve admirably in cutting down time and improving accuracy. Cooling tower calculations could readily be put in the machine-computed tabular category.

Again, in spray drying design, there are trial-and-error calculations (material and heat balances) for finding the proper temperature for preheating the slurry before spraying. Here again a trial-and-error table has already been worked out which would enable high-speed computers easily to give a considerable saving in time.

The examples cited are merely typical of many sorts of chemical engineering problems which eventually will yield to high-speed computer calculation.

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3. Donnell, J. W., and Turbin, K. L., *Chem. Eng.*, **58**, 112 (July 1951).
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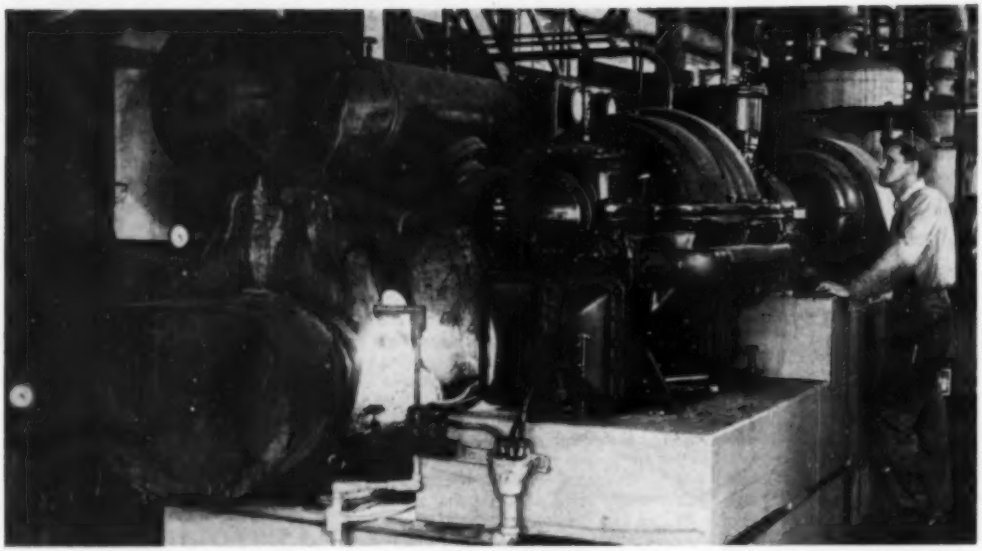
MASS SPECTROMETERS

Continued from page 131

is more than adequate for refinery control needs.

The accompanying table shows the results of accuracy checks of this mass spectrometer. Simultaneous samples were taken of the de-ethanizer stream both in the liquid phase and in the gas phase after expansion of the sample stream at the needle valve. It is evident that the analytical accuracy is very high, as shown by comparing Column (1) with Columns (2) or (3). Moreover, comparison reveals that the method of supplying a truly representative sample to the monitoring spectrometer is effective because of the relative agreement of values between Columns (2) and (3).

Initial tests on this spectrometer have been completed through the cooperation of Consolidated Engineering Corp., Socony-Vacuum Paulsboro Refinery and Socony-Vacuum Research & Development Dept. Although minor difficulties were encountered in the preliminary testing, the important mass spectrometer components functioned most satisfactorily. Taken as a whole, this development in the instrumentation field augurs well of a new era in the control of composition in complex plant streams.



First Freon centrifugal unit, installed in 1942 at the Pennsalt plant in Wyandotte, Mich., can liquefy 65 tons of chlorine a day.

Chlorine Liquefaction Modernized

This unconventional system—liquefaction in a centrifugal unit using Freon—requires less space, less power, less maintenance, loses less refrigerant, and is easier to install.

H. J. EICHENHOFER and V. N. FEDOROFF

An important stage in the production of chlorine is the liquefaction of the gaseous product for storage and transportation purposes. With some manufacturers' converting up to 95 percent of their chlorine output to the liquid phase prior to use, it is evident that the economic aspects of this operation merit serious consideration.

Until March 1942, when the first centrifugal refrigeration unit—using Freon as refrigerant—was installed at the Wyandotte, Mich., plant of the Pennsylvania Salt Manufacturing Co., the conventional refrigeration systems used by the chlorine industry included brine, liquid carbon dioxide, and ammonia.

Carbon dioxide, generally satisfactory performance-wise, possesses several undesirable features that make the liquefaction operation rather costly. This factor has been borne out in some nine years' experience in operating centrifugal machines using Freon, alongside reciprocating refrigeration systems using carbon dioxide. The following text describes the relative merits of the two methods, inasmuch as operating conditions are identical. The data apply specifically and quantitatively to the carbon dioxide system, but pertain also—for purposes of qualitative comparison—to the ammonia and brine refrigeration methods.

The centrifugal refrigerating machine installed at Pennsalt, shown above, is capable of liquefying 65 tons of chlorine per 24-hr. day, and employs Freon 11 (Carrene 2) as refrigerant.

In the evaporation stage, the cooler transfers to the refrigerant the heat that must be removed in the refrigeration process. Gaseous chlorine passes through the tubes in the cooler. Liquid refrigerant, which is contained in the shell, is in contact with the outside surfaces of the tubes containing the chlorine, and heat is transferred from the chlorine to the Freon. This exchange transforms the chlorine from gas to liquid, and converts the liquid refrigerant to the vapor state.

Liquefied chlorine is drawn off for further processing or storage. The function of the remaining two steps, compression and condensation, is to reconvert the refrigerant from gas to liquid.

The compressor draws Freon vapor from the cooler, compresses it in three stages and delivers it at a slightly higher pressure into the condenser. This compression action raises the temperature level of the vapor. At the end of the compression period it is at a higher temperature than the cooling water used in the following condensing operation.

SUPERINTENDENT EICHENHOFER *is with Pennsylvania Salt Manufacturing Co., Cornwells Heights, Pa.* DISTRICT CHIEF ENGINEER FEDOROFF *is with Carrier Corp., Cleveland.*

Passing from the compressor into the condenser shell, the gas comes into contact with the outside surfaces of tubes, through which cooling water is circulating. The heat absorbed by the refrigerant in the process of refrigeration, plus the heat added during compression, is thereupon transferred to the cooling water.

Removal of this latent heat of condensation causes liquefaction of the refrigerant, and the condensate drains into the cooler for re-use.

The centrifugal refrigeration system just described is a somewhat more simplified cycle than other methods. For example, note the contrast in its refrigeration cycle, in comparison with brine and carbon dioxide, shown at right.

The compactness of the centrifugal system is evident. Floor space and building volume requirements are at a minimum. The 65-ton unit, shown above, occupies only 200 sq. ft. of floor space and 1,600 cu. ft. of building volume.

A carbon dioxide system of comparable capacity differs considerably. With its separate compressor, condensing coils and evaporator, together with interconnecting piping and various auxiliaries, it occupies some 500 sq. ft. of floor space and 4,000 cu. ft. of building volume. With large capacity units, the space requirements are greater.

In view of the compactness and relative simplicity of design of the centrifugal machine, the field installation engineering problem is reduced to that of space and services. Lack of vibration and shock during use eliminates the need for massive foundations and permits location of the machinery on the basis of expediency and convenience. If necessary, installation can be made on an upper floor level.

Problems of location of evaporators, condensers, supports, interconnected piping and valves are also eliminated. No high pressure piping is required, since the centrifugal compressor normally operates against a discharge pressure of about 4 psi. This is in sharp contrast to the pressure in the carbon dioxide line of 60 atm., or 882 psi.

An important economic advantage: less power is necessary to compress and liquefy Freon liquor than carbon dioxide. Operating data comparisons made on the two systems, liquefying gas of same temperature and quality, and otherwise performing under identical conditions, reveal power savings of 18 to 20 percent in the liquefaction operation, per ton of chlorine liquefied, in the centrifugal unit.

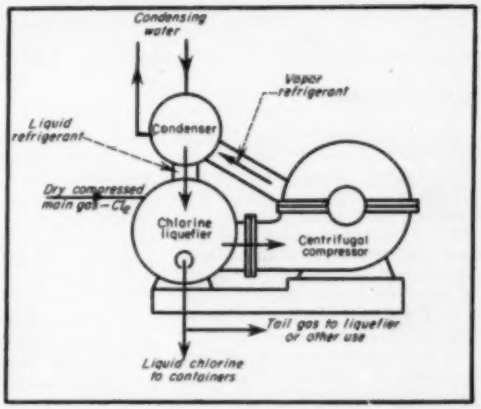
Loss of refrigerant through leakage in the carbon dioxide system averages 1.5 lb. per ton of chlorine liquefied. This loss can be reduced, but the maintenance costs in so doing offset the value of refrigerant saved.

In the Freon centrifugal system, on the other hand, refrigerant losses are only 0.004 lb. per ton of chlorine liquefied. Low operating pressures and a minimum of gasketed joints in the refrigerant cycle make this possible. Also, since design is such that any leakage that might occur is generally air leakage inward, loss through leakage is minimized by a purge recovery system that removes refrigerant from the air and returns it to the system.

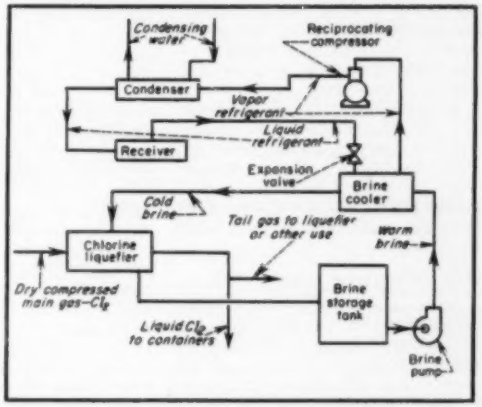
Maintenance on the centrifugal machine is inherently less than other compression systems, since wearing parts are few and readily accessible. Reductions of 49 percent in repair labor requirements and 72 percent in repair material costs have been realized from identical duty comparisons with the carbon dioxide system.

Advantages achieved with the centrifugal refrigeration unit, concerning space requirements, installation, power consumption, refrigerant loss and maintenance, have been accompanied by an excellent record of reliable performance. Its availability rates equal to that of the carbon dioxide system.

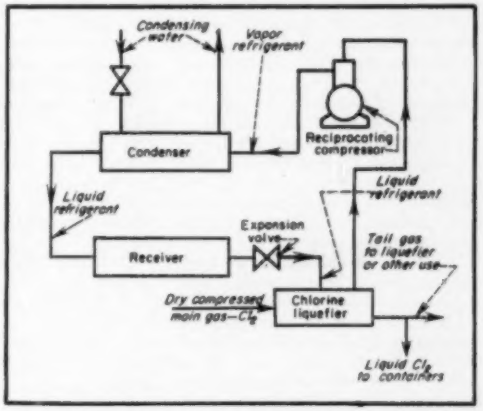
Refrigeration Cycle For Chlorine Liquefaction



NEW: Centrifugal cycle using Freon with direct expansion.



OLD: Reciprocating cycle using brine for heat transfer.



OLD: Reciprocating cycle using CO_2 with direct expansion.

Cost Estimates Answer Questions

All important decisions in a commercial engineering venture are based on information provided by cost estimates.

LOYAL CLARKE

All cost estimates have one common objective—they provide bases for decisive action. Their most obvious purpose is to answer the immediate question, "How much will it cost?" But such an answer would be of little value unless it helped to answer more fundamental questions such as: Should we build the plant? Should we expand the plant? Which process deserves further study?

In practice, cost estimates are used as a basis for making all kinds of administrative and technical decisions. When a decision is to be made regarding plant construction, cost estimates play a dominant and almost determining role. Long before this stage of the project is reached, however, cost estimates have led to other important decisions.

This article gives a few examples of how cost estimates are used at various stages of a project. Some specific estimating methods are mentioned to provide further illustration of the philosophy presented. You can use these methods or select other ones better suited to your own problems.

COST ESTIMATION DURING RESEARCH

Most new processes and improvements of old ones today originate in the research laboratory. When a new chemical reaction is discovered the question immediately arises, "Is there a possibility of developing this into an economically attractive process?" About all that you know is the reaction itself and its approximate yield; you just don't have the data needed for determining the manufacturing costs.

You can often answer this question by estimating the trading margin—the difference between the value of the product and the cost of raw materials. If the product is a new one, you may assume its value to be comparable with products currently used for the same anticipated purposes.

If the trading margin is quite large, research should be continued. More often this trading margin will be modest. If the discovery is to be studied for possible commercialization, such study should try to upgrade the uses, downgrade the raw materials, or both. The research worker should estimate the time and money required to secure adequate information. The decision to continue research will, in any event, be a matter of judgment as to the calculated risk in comparison with competing projects.[4]

As early as possible, prepare a hypothetical flowsheet and make some intelligent guesses of construction and operating costs for one or more assumed production schedules. At this stage of the development your knowledge of the process is not accurate, so that the time required for an accurate estimate would not be justified.

The equipment cost charts and estimating factors published by Chilton[5] and Lang[6] should be adequate. Factors used should be generous. It will often be desirable to make a specific estimate of piping cost, which frequently represents a large item.

The method suggested by Chilton[5] can be employed to good advantage for establishing the production cost, including the minimum desired profit margin.

The result of this will give the first semi-quantitative answer to the question, "Does the process appear attractive?" The answer may be affirmative, negative or inconclusive and, therefore, constitute a green light for continuation of development, a red light for abandonment, or an orange one showing the need for research toward process improvement.

More important, this estimate is likely to disclose the most costly features of the process. You can then suggest some specific lines of attack for further study, such as:

1. Corrosion tests to determine which materials of construction should be used.
2. Eliminating costly intermediate separations.
3. Testing lower or higher grade raw materials.
4. Market study to justify a high enough scale of production to assure profit.
5. Methods for disposal or utilization of by-products.

Ultimately, the green light must be secured or the project abandoned as a commercial enterprise. Once a go-ahead is achieved, further research should stress development of process and equipment details.

PRELIMINARY ENGINEERING

Preliminary engineering to translate laboratory and pilot plant data into equipment design, piping, layout, buildings, etc., can well start as soon as a project appears attractive. The first step in this direction should be a detailed process flowsheet with complete material and energy balances.

From the flowsheet data you can make your preliminary selection of types and sizes of equipment. You can usually choose the more favorable type by direct comparison of purchase cost of competitive types using the same utilities and performing the same function. In other cases you must consider both the direct operating costs and the installed costs of competitive equipment.

For example, consider a very large air compressor—reciprocating vs. centrifugal. If the compressor is to be driven by an electric motor, the difference in power consumption will be relatively small, so that a large difference in first cost could be decisive. If the question is, "Shall the compressor be driven by electric motor, steam engine (or turbine), or gas engine?" the cost of the source of power must be considered along with the compressor cost.

Since any engineer engaged in this kind of work will have to make many decisions of this type, it is suggested that a simple formula be developed. One such formula is:

$$C = D + aL + bI$$

The values of constants a and b can be derived for whatever conditions hold for a particular project or calculation. A suitable value for a might be 2.3, derived as follows:

Operating labor	$= 1.00\ L$
Supervision @ 25%	$= 0.25\ L$
Operating supplies @ 10%	$= 0.10\ L$
Labor overhead @ 95%	$= 0.95\ L$
aL	$= 2.30\ L$

Similarly, a suitable value for b might be derived as follows:

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Construction overhead @ 50%	= 0.50 *I*
Total investment	= 1.50 *I*
Maintenance @ 5% on 1.50 *I*	= 0.075 *I*
Taxes and insurance @ 3%	= 0.045 *I*
Investment overhead @ 2%	= 0.030 *I*
Amortization @ 10%	= 0.150 *I*
	bI = 0.30 *I*

The use of time-saving methods is very often desirable so that undue time and effort will not be expended in making decisions of secondary importance. Remember that the use of any short-cut method will introduce some uncertainty.

Before preliminary engineering is completed and construction can be started, all decisions must have been made between competitive processes, raw materials, plant sites, scale of production, etc. Cost considerations are extremely important in these choices. There will no doubt be simple factors which dictate most fundamental decisions; but somewhere along the line, there may be a choice between two lines of action in which nearly all factors must be considered in a "full-dress" estimate.

It is for this type of decision that cost estimates have their greatest utility. They present summations of the over-all effects of many factors in terms of simple over-all costs which can be understood by all persons involved. In other words, the final comparison should be on the basis of choosing the alternative which is the more attractive from an economic standpoint, considering all factors. The considerations involved are nearly the same as those for evaluating the desirability of construction.

APPROVAL FOR CONSTRUCTION

In the final analysis the decision as to whether or not to build a chemical plant facility is a complex one involving many factors. These factors must be weighed on the analytical balance of judgment. Some of the questions which must be answered are:

1. What is the total capital outlay needed?
2. What are the estimated operating costs?
3. What are the profit expectations?
4. How long must the plant operate to ensure recovery of the investment?
5. What is the break-even point?
6. What is the terminal production cost?

These questions can all be answered by engineering cost estimates, with some assistance from market research and forecasting. Let's discuss each of them briefly.

Total capital outlay includes the cost of the site, roads, offices, change houses, steam plant, cooling towers, etc., as well as the manufacturing units. It is very important, first, because it represents the amount of money which must be secured before the project can proceed. Second, it is money which is risked against the remote—but always present—possibility of failure through poor performance, changing market conditions, and process obsolescence occasioned by newer developments.

Strictly speaking, operating capital is part of the initial investment and must be considered in financing the project. Operating capital consists largely of raw materials inventories plus cash reserves to provide for payment of salaries and wages. Much of the plant inventory is salable; there is little risk in these items, and there is no need for amortization. Operating capital should be estimated separately from the fixed plant investment.

Operating costs include all expenses attendant to ownership and operation of the plant. Direct operating costs include labor, raw materials, utilities, and all other expenditures required while the plant is operating but not required when it is idle. Indirect or fixed costs include such items as real estate taxes, office overhead and interest on borrowed capital. A very large indirect cost is the provision for amortization of the fixed investment.

The allowance for amortization could be assigned according to any one of three theories. The first amortizes each piece of equipment over its expected useful life. The second allows for amortization at the rate which the government would allow in computation of income for tax purposes.

The third method bases amortization on a period corresponding to probable life of the entire process. This method represents a more realistic approach and, therefore, a more useful method for engineering cost estimates.

The oil tanks in a tank farm may have an expected life of more than 40 yr., and the Treasury might allow a 30-yr. period to be used for depreciation. But who can say now that there will be any need for this facility at the end of 30 or 40 yr.? It is risky enough to predict that any proposed plant will be operating five or ten years before new conditions make it obsolete.

If a ten-year amortization is assumed, the estimate represents the cost of operating for ten years followed by abandonment. Actually, complete abandonment is usually not probable, as it may be cheaper to operate an obsolete plant than to abandon it. This is possible when the revenue of the plant exceeds all operating costs other than amortization.

Profit expectations are usually based on the assumption that the plant will operate for a definite period, say five or ten years, under specified market conditions. To be comprehensive, corporation taxes must be included in this estimate. In some cases, such as the first project of a new company, tax estimation is simple, and a detailed knowledge of accounting procedure and legal interpretations is not needed to estimate the tax. In most cases, however, engineers should allow management and tax accountants to compute the tax.

Recovery of the investment can be expressed in terms of payout period. This is the length of time required for the gross profit (before taxes or amortization) to equal the plant investment. This is in effect an answer to the question, "How long must the plant operate to insure against irrecoverable loss?"

The payout period is probably the most useful single figure, since it affords a comparison independent of ordinary amortization and corporation taxes and involves the shortest projection of market conditions and other cost factors into the future. Thus, uncertainties as to future conditions will have less effect on estimated payout period than on estimated long-term profit.

Break-even point is an index of how much below full capacity the plant can operate without loss. Although chemical markets are among the most stable, even so you must face the possibility that sales volume will not always equal productive capacity. If the operating cost has been broken down into fixed and variable costs, break-even point can be found readily by graphical methods or the formula:

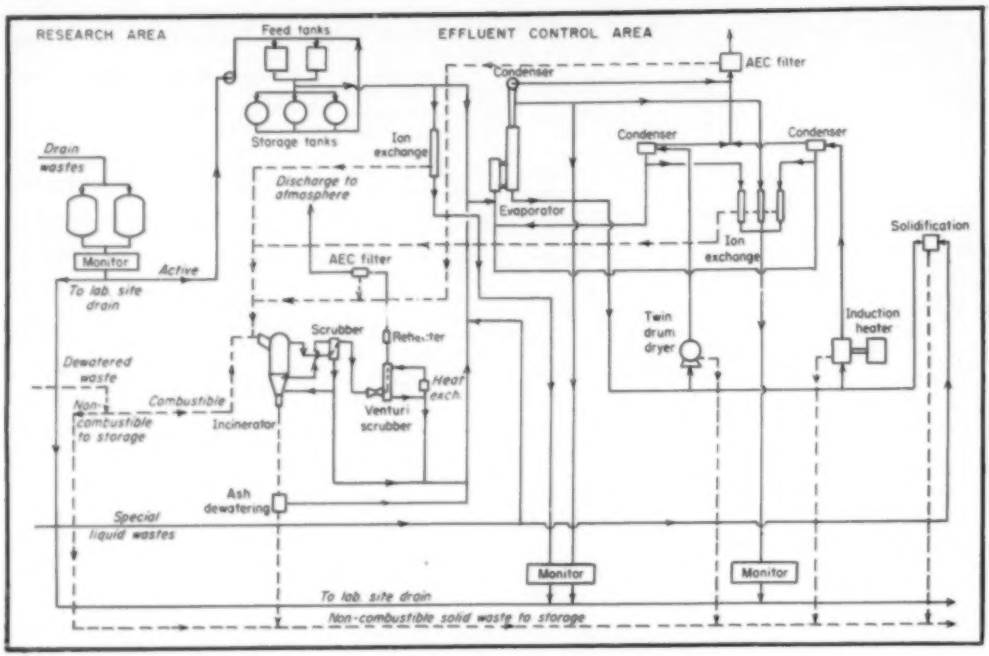
$$X = F/(S - V)$$

Such methods are of limited accu-

(*Continued on page 150*)

NOMENCLATURE

- C = Comparative annual manufacturing cost
- D = Annual cost of utilities and raw materials
- F = Fixed annual costs
- I = Installed cost of equipment and piping
- L = Annual wages of operators
- S = Annual sales revenue for full operation
- V = Annual variable costs for full operation
- X = Fraction of full plant capacity at break-even point
- a = Constant which totals all labor-dependent costs
- b = Constant which totals all investment-dependent costs



HERE FOR THE FIRST TIME ARE COMPREHENSIVE DATA ON THE EQUIPMENT, ENGINEERING AND COSTS OF:

Radioactive Waste Disposal

At Argonne National Laboratories every 100 cu. ft. of radioactive solid material is reduced to 25. Harmful liquids are concentrated to about 0.2 percent of original volume, reduced still more by drying. It adds up to saving $300,000 a year.

WALTON A. RODGER and PHILLIP FINEMAN

In the early days of the Manhattan project, most radioactive waste solids and liquids were buried, gases were diluted and discharged through tall (200-300 ft.) stacks. Under wartime stimuli there were more important things to worry about than the economics of radioactive waste disposal but today there is no excuse for excessive disposal costs. Furthermore costs have spiraled. Today's tank farms come high; $1 or more per gal. of waste material stored. Added to this are remote dangers of health hazards.

Today, the established principle is to concentrate the waste material into small bulk and store the active residue. This way, storage costs are cut in direct ratio to bulk.

There is no single solution to the problem because no two waste-disposal problems are alike. However, the systems which have been developed at Argonne National Laboratory are considered a sound approach both from the standpoint of health and of economics. They apply to a development laboratory in a populous area.

GASES ARE FILTERED

Briefly, radioactive gases are filtered with a highly retentive paper-asbestos filter known as an AEC Filter.

The load on the AEC Filter is lessened by the use of fiber glass prefilters. After filtering, the harmless gases are discharged to the atmosphere.

So far, the units have given satisfactory service for more than 8 mo. in a non air-conditioned building.

The filters are sensitive to moisture in the air, however, and several have been replaced for this reason.

SOLIDS ARE BURNED, BURIED

The difference in cost between burning and burying solid wastes is demonstrated in the table beside the incinerator cut. First step is separation.

NON-COMBUSTIBLES

The combustible waste goes to the effluent control area for incineration

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and the non-combustible is taken directly to the solids storage area. This area consists of concrete lined trenches into which are placed black iron boxes, 4 by 5 by 6 ft. The trenches, which have removable wooden covers, are regularly monitored to see that active liquids are not building up. The bins are of such a size that eventually they may be covered, loaded on railroad cars, and shipped to a possible national graveyard. This storage is expensive, $7 per cu. ft. The collection process costs another $5 per cu. ft. making the total cost of solid storage by this method almost $12 per cu. ft.

COMBUSTIBLES

Combustibles are separated because of the cost of solid storage. Nearly 80 percent of solid wastes are combustible. They are burned in the unit shown. It consists of a burning chamber capable of handling 100 cu. ft. per 8 hr. day. The charge is introduced through a chute equipped with interlocked doors to prevent escape of radioactive gases and the bags of charge build up on the grates of the furnace. These are ignited with gas jets, combustion air being supplied above and below the grates through tuyeres.

During most of the burning period the combustion is self supporting. The gas jets are again used for final ashing. The ash falls through the grates into water and settles down the collection cone through an 8-in. plug valve into a collection drum fitted with an expendable cloth bag filter. When the drum is full of ash, the valve is closed, a new container inserted and the filter bag is used to dewater the ash to sufficient dryness to allow storage in freezing weather.

Combustion gases must, of course, be freed of their radioactivity before discharge. On leaving the furnace, the gases pass first through a Schreier-Bartolucci vane plate washer where the larger pieces of fly ash are scrubbed out with a water stream which also serves to cool the gases. Water for this scrubbing operation is pumped from the bottom of the furnace to the top of the Schreier-Bartolucci tower and returned from the bottom of the tower to the lower portion of the combustion chamber.

The gases are then passed to a Pease-Anthony venturi where the high velocity gas stream is used to disintegrate a water stream which is admitted at the throat of the venturi. This intimate mixture of air and water is admitted tangentially to the bottom of a Peabody scrubber. In this disengaging section, the gas and the droplets of water now containing a large fraction of the smaller particles of dust are separated. The gas flows upward through the Peabody tower, passing through fine holes in the scrubbing plates where the gas is brought into further intimate contact with water or a suitable alkaline scrubbing solution. In the upper portion of the Peabody tower, the gas and water are separated by a mechanical baffle system, the gases then flowing to an electric heater located above the scrubbing tower. Sufficient heat is added in this reheater to vaporize any fine mist particles which are still present in the gas and to raise the gas temperature several degrees above the dew point, thus preventing condensation in the remainder of the system.

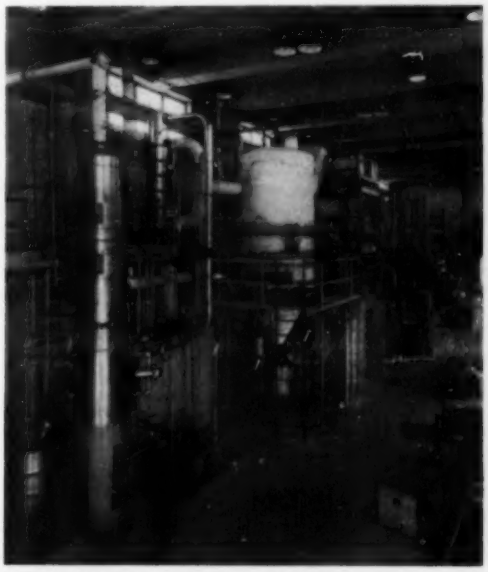
Both liquid systems must periodically be drained and recharged. The liquid collected is put into the regular effluent control building liquid system to be described presently.

The preceding treatment may be enough in most cases of operation to reduce the radioactivity to a permissible level. However, as a final safeguard, the gases are passed through a filter of the AEC type. Such a filter is capable of removing radioactive particles to well within tolerance levels under operating conditions. When replacement is necessary, the loaded filter is burned in the furnace. From the filter the gases are drawn through a positive displacement blower and discharged above the roof.

The incinerator is now on routine operation and is processing the daily accumulation of contaminated combustible wastes. The exhaust gas of the unit has always been well below the design specifications for safe limits of beta air contamination. The incinerating unit is producing about 6

INCINERATOR COST	
Engineering and design	$ 50,000
Equipment cost	40,000
Installation	30,000
Total	$170,000
OPERATING EXPENSES (ANNUAL)	
(25,500 cu. ft./yr.; 100 cu. ft. charged/day)	
Gas (100 cu. ft./hr.)	18
Water (13 gal./min.)	392
Electricity	272
AEC Filter (1 per 5 days, $40 ea.)	2,080
Labor and supervision (2 man hr./hr. for operators) (¼ man hr./hr. for supervisor)	9,360
Depreciation	23,000
Maintenance	8,160
Overhead	8,160
Building amortization	6,900
Handling and storage (6 cu. ft./day ash stored) (1 filter bag/day at $3.75 ea.) (Ash handling at $4.00)	12,500
Total operating expenses	$ 70,862
Cost per cu. ft. of material burned	$2.78
Cost per cu. ft. unprocessed material (Collected and stored)	11.68
Cost per cu. ft. of delivery to process area, processing and storage	7.57
Savings per cu. ft. by incineration	4.11
Annual savings	$105,000

SAVING: $105,000 per year.



INCINERATOR burns 80 percent of solids.

EVAPORATOR COST	
Equipment	$14,400
Installation	3,500
Total	$17,900
OPERATING EXPENSES (ANNUAL)	
Water (40 gal./min.)	1,170
Steam (11,750 lb./day)	3,000
Electricity (feed pump)	20
Labor and supervision (1 man hr./hr. labor) (1 man hr./hr. supervision)	5,300
Maintenance	4,100
Depreciation	3,580
Overhead	4,100
Reagents	200
Building amortization	2,000
Cost to concentrate 290,000 gal. of 0.08 wt. percent waste to 640 gal. of 45 wt. percent solution	$23,470
Cost per gal. feed processed	0.081

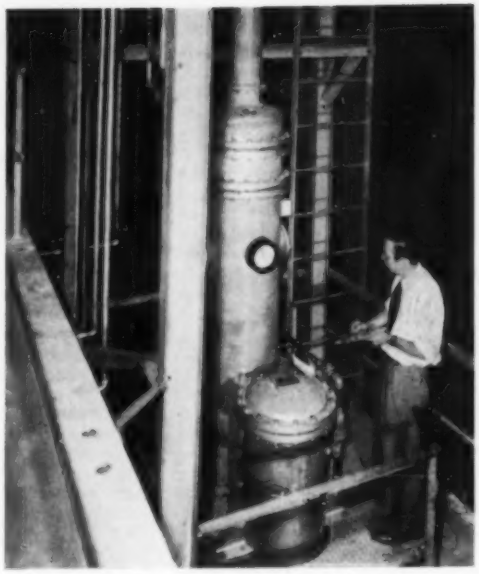
BASIS OF COSTS

Throughput of 1,200 gal./day at a steam economy of 0.85 lb. condensate/lb. steam used.

Operation for 18 days with 1 day of maintenance to produce 48 gal. of 45 wt. percent concentrate.

No reflux.

Steam used on days set aside for maintenance.



SAVING: $200,000 per year (including drying).

EVAPORATOR condenses 290,000 gal. to 640 gal.

cu. ft. of ash per 100 cu. ft. of charge. Even though the installed cost (including engineering) is about $120,000 an operating saving of about $400 per 100 cu. ft. processed is expected and the unit should pay for itself in a little over a year.

LIQUIDS ARE TOUGH TO HANDLE

Again, the first step is segregation. The scientist attempts to collect all process wastes into portable containers of various types. These are supplied and replaced on request. These small volume—often very highly active wastes—are neutralized if necessary, with slaked lime, mixed with portland cement, hardened, and shipped to a final storage area. This processing is done in a shielded work area.

All persons are instructed to allow no activity to get into sink drains if at all possible. Because this is not always possible, the drains of all laboratory sinks are conducted to retention tanks. These are 1,500 gal. glass-lined tanks which operate in pairs. When one is full, the flow is diverted to the other and the first is sampled. If the gross level of radioactivity is less than a predetermined level of safety, the contents are discharged directly to the laboratory site drain which carries—in addition to the retention wastes—cooling water which is known to be activity-free. These then enter the laboratory site treatment plant which comprises two longitudinal settling tanks having 24 hr. detention periods. The pH of the wastes is here adjusted whenever necessary. The tanks are so designed that, should it be necessary, further chemical treatment can be applied. The laboratory site drain by-passes the sewage plant, but enters the laboratory outfall ahead of the exit monitor where a continuous record of the discharge is to be kept for legal purposes. The outfall carries some 400,000 gal. per day of sanitary wastes which is admixed with the industrial wastes already discussed (from laboratory site treatment plant). It is expected that about 80 percent of the retention tank wastes may be discharged without treatment.

If the activity of the retention tank waste is of a level greater than the maximum permissible for discharge the waste is pumped into a tank truck and brought to the effluent control area where it is discharged into the "in-process" holding tankage of which there is a total of 36,000 gal.

BASIC COST CALCULATIONS USED THROUGHOUT	
Steam, 1,000 lb.	$1.00
Water, 1,000 lb.	0.03
Electricity, kwh.	0.0083
Gas, 1,000 cu. ft.	0.70
Labor, hr.	2.00
Supervision, hr.	2.40
Equipment depreciation, yr.	20 percent of total
Equipment maintenance	100 percent direct labor
Building amortization	10 yr. period
Operating year, 8 hr. day,	255 days yr.
Cost of liquid storage, gal.	$1.00
Cost of solids handling, storage, cu. ft.	11.68
Cost of solids storage alone, cu. ft.	6.89

Wastes requiring processing are drawn from the holding tanks to a primary evaporator where they are concentrated. The overhead is monitored and discharged to the laboratory site drain or, if necessary, may be given additional cleanup with an ion-exchange column.

The bottoms are then fed to one of two drying set ups, either induction or twin drum drying; or are subjected to the solidification process previously described. Overheads from the latter stages are put through resin columns or returned to the primary evaporator. Solids are sent to storage bins.

EVAPORATION

The primary evaporator (see cut) is a vertical tube, natural circulation evaporator. The evaporator has the advantages of (1) adaptability to maintenance, (2) effective three stage entrainment separation, and (3) ease of operation. The main disadvantage is the possible fouling of the heat transfer surfaces by scaling and salting. The unit is fabricated of stainless steel (Type 316) throughout, and is composed of a steam chest, separator chamber, overhead condenser, constant head feed tank, and control instruments to facilitate operations. The steam chest is 18 in. in diameter and contains 58, 5-ft. long, 1¼ in. BWG-

TWIN DRUM DRYER COST	
Equipment	$20,000
Installation	1,000
Total	$21,000
OPERATING EXPENSES (ANNUAL)	
Steam (55,000 lb.)	55
Water (15 gal./min.)	210
Electricity	10
Labor and supervision	2,230
Maintenance	1,850
Depreciation	4,200
Overhead	1,850
Packaging, Handling and Storage	750
Building amortization	1,000
Total	$12,055
Cost per gal. feed material (in twin drum dryer)	$3.84
Cost per gal. original waste (0.08 percent)	$0.0085

BASIS OF COSTS

50 lb. per hr. of 45 percent solids feed (sp. gr. 1.32)(640 gal./yr. — 7,000 lb. — from evaporator).

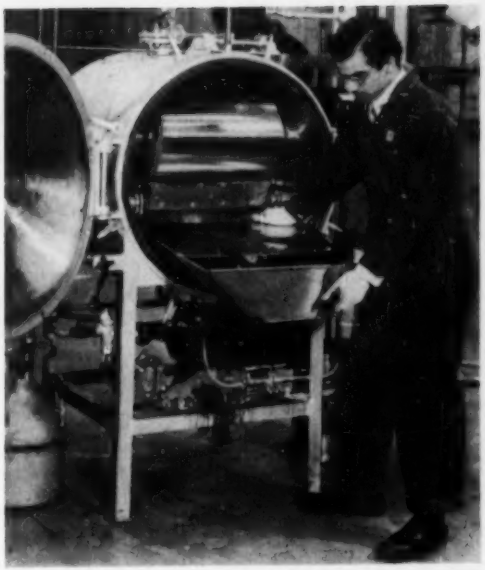
60 lb. per hr. of 20 percent solids feed (sp. gr. 1.15)(2,500 gal./yr. — 24,000 lb. — from miscellaneous sources).

900 hr. operating time, 540 hr. for 45 percent solids feed; 360 hr. for 20 percent solids feed.

Steam economy 0.5 lb. overhead/lb. steam.

Dry to 90 percent solids.

SAVING: Both dryers need more study.



TWIN DRUM DRYER: to 90 percent (wt.) solids.

16 tubes that provide 106 sq. ft. of heat transfer surface. The vapor and entrained liquid leave the steam chest via a centrifugal separating section and enter the separator. The separator is 20 in. in diameter and 13 ft. high and the entrained liquid is caught in this chamber where natural circulation returns it to the steam chest. The vapor passes through the separator vapor space and is more completely deentrained by a Centrifix scrubber and reflux if desired. The vapor is then condensed in the triple-pass surface condenser and returned to a 3,300 gal. storage tank for monitoring. The boil-up rate is 150 gal. per hr. at 15 psig. steam pressure.

This unit has been in routine operation for 6 mo. It has been demonstrated capable of concentrating contaminated liquid waste from 0.08 wt. percent solids to 45 wt. percent solids. The beta activity of the overheads has never exceeded 7×10^{-7} microcurie of beta per cc. A steam economy of 0.85 (lb. condensate/lb. steam) has been attained. Operating with an acidic feed, scaling has not been a problem and foaming has not caused any trouble.

The evaporator cost about $18,000 installed and operates at a cost of $0.08 per gal. processed. Although this and other equipment are pilot plant units which were designed to get information on waste handling, they are of such a size as to allow successful handling of wastes produced during the next two or three years assuming the system works out all right. Cost figures are heavily weighted by amortization because processing rates are low and the figures quoted could be bettered considerably by larger installations at production sites.

ION EXCHANGE

Ion exchange has been recognized for some time as a possible method of removing active ionic impurities from wastes. A program was initiated to determine the feasibility of decontaminating laboratory drain wastes by this method, and further, to compare the cost of ion exchange decontamination with the cost of evaporation. The regeneration and decontamination of the resin with a minimum volume of regenerant is a critical item. An alternative to regeneration is to burn the resin as combustible waste, a less desirable approach if regeneration is possible.

A two-bed system was set up, consisting of 0.05 cu. ft. of cation resin, nuclear sulfonic-polystyrene type (Nalcite HCR, sodium form), and 0.11 cu. ft. of anion resin, quarternary amine type (Nalcite SAR, nitrate form), both resins being contained in 2-in. internal diameter Pyrex glass pipe.

Through this system was passed a filtered laboratory drain waste having a gross alpha and beta activity of about 2.6×10^{-6} microcurie per cc., a pH of 2.6 and a total solids of 670 ppm. The flow rate was approximately 1.2 gal. per min. per cu. ft. of cation resin.

A total of over 3,000 gal. of filtered drain waste has been decontaminated under the above conditions without regeneration of the resins. This is equivalent to 60,000 gal. per cu. ft. of cation resin, or 20,000 gal. per cu. ft. of total resin. It was found that while the cation bed became exhausted (as far as hardness ions was concerned) after 250 gal. were treated, the radioactivity was continually removed. Analyses of samples taken after passing through the cation bed, and after passing through both beds, have both averaged 3.6×10^{-8} microcurie per cc., indicating that the anion bed was ineffective. It appeared likely that radioactive anions were not present in large amounts, and that those radioactive ions that were present were not removed to an appreciable extent by the anion bed. Additional evidence for this was the fact that no radioactivity was apparent on the anion bed by Geiger-Mueller meter survey, but the top 6 in. of the cation bed showed appreciable radioactivity.

In order to confirm the above findings, and to determine the feasibility of decontaminating drain wastes of higher activity, a second system of ion exchange beds, identical with the first, was set up and filtered drain wastes to which were added mixed fission products to an activity level of 4×10^{-5} microcurie per cc. were

passed through. So far, 900 gal. have been processed through this unit. The effluent activities have averaged about 3.6×10^{-6} microcurie per cc. It appears that the effluent activity is due to "leakage" rather than exhaustion of the resin. Contrary to the behavior of the first ion exchange system, the anion bed is removing significant amounts of radioactivity as determined by sampling both columns and by Geiger-Mueller meter surveying of the anion column.

A mixed bed system is now under construction. This system will be used to determine if it can decontaminate the high activity drain waste more successfully than the two-bed system.

DRYING

On as small a volume scale as this, it may not be economically justifiable to further reduce the volume. However, there are good health and public relations reasons for avoiding a liquid tank farm in a populous area.

Twin drum drying is a standard commercial drying method. The unit in use is a vacuum twin drum dryer made of stainless steel, the inside having an ASTM #4 finish. The rolls are 12 in. in diameter and 18 in. long, providing 9 sq. ft. of heating area. It has a variable splash feed, variable drum speed and is operated so that drying is not quite complete to give a non-dusting product which drops into a collection pan. This pilot unit does not provide for remote product removal and therefore cannot be used on high-level wastes. This installation cost about $21,000 and operates at a cost of $0.01 per gal. of original waste.

A somewhat more radical approach is the induction drying equipment. Here the concentrated solution is evaporated by introducing it into a non-conducting container situated inside copper coils to which are fed 25 kw. of 27.3 megacycle radio-frequency power through a coaxial cable. The solution boils due to eddy currents set up inside it so that there is no problem of scaling heat transfer surfaces. There are two ways of handling the product removal problem. If a sufficiently cheap plastic can be found which will stand the temperature, the evaporating container can be disposable. Or, the container can be shaped in the form of a truncated inverted cone and the product dries to such a hard cake that it will drop out upon inversion of the container. This equipment cost about $21,000 installed and operates at a cost of $0.01 per gal. of original waste.

The calculated cost of complete treatment of a gallon of drain waste is computed at $0.09. Since storing the unprocessed liquid waste would cost about $1 per gal., assuming a rate of 290,000 gal. per yr. of dilute drain waste, an annual savings of approximately $260,000 may be expected.

The whole system has not been in operation long enough to provide answers to all the questions but early indications (as noted) are sufficiently encouraging to allow the belief that a thoroughly practical system has been worked out.

ACKNOWLEDGMENT

The authors wish to express their appreciation to the following Argonne staff members: A. E. Aikens, Jr., D. C. Hampson, and W. R. Walters; and to O. C. Purdie (assigned to Argonne National Laboratory by E. I. du Pont de Nemours & Co., Inc.) who were responsible for the experimental programs reported herein. We also wish to acknowledge the assistance of various members of the Graphic Arts Section.

COST ESTIMATES

(Continued from page 145)

racy, since the division between fixed and direct costs is not always clear cut. For example, a unit kept in standby condition may require some labor and enough steam to prevent freezing. Conversely, the full allowance for maintenance may not be needed for idle units. In many cases the break-even point computed by an approximate method will be within the required engineering accuracy. If a more accurate calculation is desired you can estimate the operating costs for several production rates and plot the results.

Terminal production cost may be low enough to extend the useful life of a plant. Even though a plant may be installed on the basis of a 5, 10 or 20-yr. operation, it is well to look ahead to the time when the plant has either been written off the books as completely amortized, or at least could be written off with reserves accumulated out of earlier profits. No further provision need be made for amortization, and that item disappears from cost computations.

With this burden removed, the production cost is reduced to a terminal value. Many a plant has been saved from the scrap pile because this terminal cost could meet competition from newer, more efficient plants still saddled with the need of providing for amortization.

We have just reviewed some of the more important considerations involved in evaluating the desirability of construction. Cost estimates supply much of the information needed. When supplemented by market studies only a few questions regarding strictly business matters of the company need be settled, so that an intelligent decision can be made regarding construction of plant facilities.

Since the engineer has supplied management with the lion's share of data, he should make his recommendations an integral part of the estimate and should point out favorable or unfavorable circumstances which do not appear in the cost figures.

ON PERSONAL EQUATIONS

Every person has a different way of looking at cost estimates and a little different way of defining the terms used in describing various cost factors. If you are preparing an estimate solely for your own use you can use any understandable system to arrive at your conclusions. When your estimate is to be studied by others, however, you should endeavor to use terms readily understood by them. In any event, clearly define your terms in the report accompanying the estimate and state the approximations and assumptions used.

Why not standardize cost estimating procedure? Progress in standardization has been made; let us hope that it will continue.

In the meantime, it is best to recognize that perfection has not yet been achieved and that approximations of the truth must be made if cost estimation is of itself not to become too costly. We should use this criterion: Does the estimating procedure used answer the questions of management within the engineering accuracy required? When approximations are accepted on this basis, you should feel confident that you have not overlooked any easy means of improving accuracy and that the results can be understood by management.

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How to Scale Up a Rotary Kiln

Here are four short-cut formulas designed for fuel economy, derived from a surface-area concept. Use them to find . . .

1. **The right dimensions for equivalent fuel usage.**
2. **The right diameter for equivalent dust pickup.**
3. **The proper speed of rotation.**
4. **A fuel approximation for extra-large kilns.**

J. A. LUETHGE

Finding the optimum production for a rotary kiln (other than a lime or cement kiln) is often a matter of intelligent experimentation. The engineer tries different speeds, temperatures, air flow, drafts and eventually achieves maximum production at minimum cost.

Later, if the plant expands, the engineer may be asked to estimate the best dimensions for a new kiln to process a larger quantity of material.

Rigorous mathematical treatment is probably impossible so simplified formulas have been derived for the scale up of rotary kilns.

Gibbs[6] related production capacity to kiln volume:

$$Q_d = KD^2L/100$$

It has also been stated[9] that a lime kiln should process one ton per day for every 35 cu. ft. of space inside the kiln lining, with the qualification "that in the case of larger kilns, volumetric efficiency becomes less while in the case of smaller kilns it tends to become better."[9] This volume concept is apparently accepted as a basis for short-cut formulas,[11] although studies in England came to conclusions at variance with this volume concept. Martin[8] maintained that:

Maximum production from rotary cement kilns of the same shape is proportional to the diameter squared times the ratio of terminal speed (S) of the kiln gases to the volume (V) of gases per ton of material produced.

The derivations showed that the S/V term becomes a constant when the fuel usage per ton of product does not vary. If the shape of a set of kilns is the same, the diameter is proportional to the length. Hence, the capacity of kilns, according to this author, is not related to the volume but to the product of the diameter times the length, which is known to be proportional to the heat transfer area.[7]

Gilbert[5] presented charts indicating that a change from 2 ft. to 15 ft. in the diameter of cement kilns increases the heat transfer per unit area by an average of 25 percent in various zones while the heat transfer per cubic foot decreases an average of 80 percent. These results show that, where fuel economy is a factor, an area concept of kiln capacity produces worthwhile, although slightly conservative, short-cut formulas for sizing kilns.

The area concept has led to the derivation of these formulas. They have been verified by data from the performance of full-scale rotary kilns processing fine-sized material at medium temperatures. (Discharge temperature of approximately 1,800 deg. F.)

▶ Proper dimensions for equivalent fuel usage:

$$Q_d = x\,DL \qquad (1)$$

▶ Proper diameter for equivalent dust pickup, per ton product:

$$Q_d = yD^2 \text{ or } D = x/y\,L \qquad (2)$$

(Conditions of Formula (1) must be fulfilled.)

▶ Proper speed of kilns (without dams) sized by Formulas (1) and (2):

$$Q_d = k\,D^2\,S \qquad (3)$$

▶ Short-cut approximation of fuel usage for larger kilns producing the same tonnage:

$$F = n\,(1/DL)\theta \qquad (4)$$

Formula (4) is a generalized statement concerning the fuel economy possible in specifying a longer or larger kiln than dictated by the use of Formulas (1) and (2). Note that fuel savings can be achieved only where high discharge temperatures of waste gases indicate that economy is possible. Experiments with two kilns of different sizes and exit-gas temperatures, normally at 800 deg. F., developed a value for θ of 0.6, although θ can be any number from zero to one, depending primarily on the temperature of waste gases. To prevent misuse, the formula should be used only when a change in dimensions of no more than 25 percent is planned.

NOMENCLATURE

- a_c = Cross-sectional area of charge.
- A = Surface area of charge.
- A_{rc} = Area of contact of charge and kiln walls.
- A_r = Inner refractory area.
- c = Chord length formed by surface of charge.
- D = Inner diameter of kiln, feet.
- F = Fuel usage per ton of product, any units.
- F_{cf} = Radiant heat transfer coefficient.
- h = Height of charge.
- l = Arc of contact of charge and kiln wall.
- L = Length of kiln, feet.
- m = Cross-sectional area of opening.
- N = Slope of kiln, inches per foot.
- q = Btu. transferred per hour.
- Q_d = Optimum production, tons per day.
- r = Inner radius of kiln.
- S = Speed, revolutions per minute.
- t = Retention time of charge in kiln, minutes.
- T_c = Temperature of charge (absolute).
- T_f = Temperature of gases (absolute).
- T_{fr} = Average temperature of inner kiln wall (absolute).
- T_o = Atmospheric temperature (absolute).
- T_r = Temperature of kiln wall in contact with pigment (absolute).
- U = Convection heat transfer coefficient.
- U_r = Heat transfer coefficient, inner kiln wall to external atmosphere.
- U_{rc} = Heat transfer coefficient, charge to kiln wall.
- v = Velocity of gases.
- $a, b, e, i, j, k, K, n, o, p, w, x, y, z$ = Constants at the conditions specified.
- oc = Sliding angle of charge.
- σ = Stefan-Boltzmann Constant.
- θ = Constant at conditions specified.

J. A. LUETHGE *is a member of the Project Engineering Department of the Titanium Division of National Lead Co., a graduate of George Washington University. His plant manager comments: "The principles expressed have been proved to be applicable to our equipment, and have been used to evaluate and improve the operation of our rotary kilns."*

How to Use the Four Formulas

1. THE PROBLEM

A kiln 150 ft. long and 7.5 ft. in diameter is processing an optimum production of 100 tons of fine-sized material per day, at 500 cu. ft. of fuel gas burned per ton. The temperature of waste gases is 800 deg. F. The refractory lining is 9 in. thick, and the kiln rotates at 5 min. per rev. A new kiln to process 150 tons per day at the same fuel usage per ton and dust pickup is required.

THE SOLUTION

The dust pickup must be comparable so formula (2) is used:

$$y(D_1)^2/y(D_2)^2 = 100/150$$
$$D_1 = 7.5 \text{ ft.} - 1.5 \text{ ft. of brick lining} = 6 \text{ ft.}$$
$$(D_2)^2 = 150/100 \times 36$$
$$D_2 = 7.4 \text{ ft.}$$

Thus, a shell inside diameter of 9 ft. is required. Substituting in Formula (1),

$$7.5L/6 \times 150 = 150/100$$
$$L = 180 \text{ ft.}$$

A kiln length of 180 ft. is specified. The speed of the kiln must be changed to maintain comparable economy at this production, so Formula (3) is used.

$$150/100 = (7.5)^2 S/(6)^2 \times 0.2$$
$$S = 0.15$$

The new speed should be $6\frac{2}{3}$ min. per revolution.

2. THE PROBLEM

In the case just cited, suppose the space available permits a kiln 225 ft. long, and that the high discharge temperature of the gases indicates possible economy. Would the fuel savings obtained justify the added expense for the longer kiln?

THE SOLUTION

Since the change in length is 25 percent, the approximation of Formula (4) is permitted:

The factor θ is assumed to be 0.6

$$F_2/F_1 = (7.5 \times 180/7.5 \times 225)^{0.6}$$
$$F_2 = 0.88 \times 5{,}000 = 4{,}400 \text{ cu. ft. per ton (approx.)}$$

The savings in fuel now can be easily calculated and compared with the added cost of the longer kiln. It should be recognized that the speed of the kiln should remain constant to achieve the maximum savings. This requirement can be developed by using the two equations below.

Further discussion of these equations will be found on the next page in the section on derivation.

$$Q_d = pDFL/t$$
$$t = zL/DS$$

Derivation & Limitations of the Formulas

The development of these short-cut formulas necessarily requires the following approximations, not exactly true but close enough for normal kiln capacity and dimension estimation.

1. The same degree of roughness of charge surface will exist in any set of kilns operating at optimum speeds and processing the same material. Materials of fine particle size would more closely approach this approximation.

2. In any set of kilns, the auxiliary heat-exchange equipment must be comparable. The formulas would be less accurate when applied to kilns with quadrated zones and chains, which would tend to distort proportionality of the heat transfer to the diameter-length product.

3. The time-temperature gradients should remain reasonably constant. This is the same as saying a specific product will receive the same processing in any set of kilns. From this, it is assumed that the coefficients of heat transfer by conviction, conduction and radiation will remain reasonably constant, in view of the constant fuel usage per ton required.

4. The heat loss through the kiln walls must be small before Formula (4) can be used. For the test kilns, a heat loss of 5 percent was calculated from outside kiln shell measurements.

5. The charge height should be proportional to the inner diameter in any set of kilns.

It is usually worthwhile to design the retaining dams so that their height is proportional to the inner diameter of the kiln. In this way, the area of opening for escape for gases will increase directly as the square of the diameter in any set of kilns, and the pressure loss through this restriction will usually remain constant. It is obvious that as the charge height in a kiln approaches the inner radius as an optimum, the area of heat-transfer surface and the resultant heat transfer approaches a maximum value.

The formulas are conservative for sizing large kilns, it will be noticed, because kilns of larger diameters sized by these formulas have longer retention times. Adjustment of the time-temperature gradients will result in slightly more production at the same fuel usage or slightly higher fuel economy. The amount was small enough to be within the limits of error in the measurement of the data obtained for the kilns studied.

For a given set of kilns, the following proportional relations are developed, (see cut):

$h/h' = r/r' = D/D'$ is given:

and since equal angled right triangles are formed by the angles and subtended chords, then:

$c/c' = D/D'$, $l/l' = D/D'$, $a_c/a'_c = [(D/D')^2$

and

$$m/m' = (D/D')$$

Translated in terms of kilns, these relations are:

1. The surface area of the charge, cL, is proportional to the diameter times the length, DL.

2. The area of contact of the charge with the refractory walls is proportional to the product, DL.

Formula 1 can be derived from the equation for heat transfer in a combustion chamber[10] modified to fit a rotary kiln:

$$q = \sigma(T_f^4 - T_s^4)AF_{sf} + UA(T_f - T_s) + U_cA_c(T_f - T_s) + U_{ss}A_{ss}(T_s - T_s)$$

However, at optimum production in a set of kilns with the temperature of gases and material constant and with the flow of gases per ton of product and the composition of gases constant at equivalent fuel usage, the emissivity, conduction, and convection coefficients are also substantially constant. The equation becomes:

$$q = aA + bA_c + eA_{ss}$$

The areas A, A_c and A_{ss} are each proportional to DL, so

$$q = iDL$$

The quantity of heat transferred governs the amount of material that can be processed:

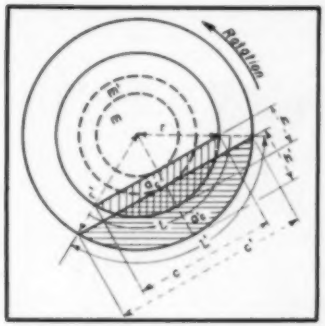
$q = jQ_d$, and $Q_d = xDL$

The relationship was evaluated using data compiled from operation of 15 kilns of five different combinations of dimensions processing four different materials. Most of the data were developed by separate investigators without a knowledge of the short-cut formulas, and no attempt was made to obtain exact optimum speeds although, of course, there was an attempt to obtain consistent fuel economy.

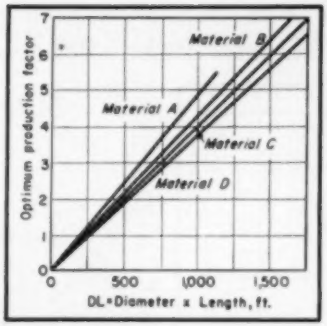
The second cut on the next page shows that the correlation of production and DL are within the limits of experimental error. The actual production in tons per day has been multiplied by a factor and the curves plotted for the figure.

Formula (2) is derived as follows:

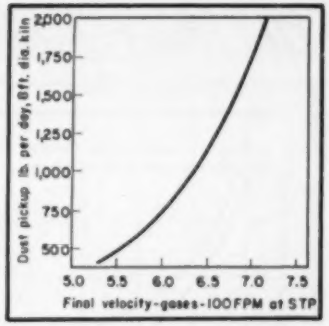
The dust entrainment in several kilns has been found to be a function of the velocity of gases (see cut) and



THEORY: basis of the formulas are the geometric proportions outlined above.



PROOF of the surface area concept: as DL increases, so does the optimum production.



LIMITATIONS: as the velocity of kiln gases increases, dust pickup increases.

is obviously a function of the surface area of charge in the dry zone for a specific material undergoing similar processing. At a constant fuel usage per ton, the volume in cubic feet per minute of gases is proportional to the tonnage of the product, and the surface area is proportional to the tonnage as a result of Formula (1). Therefore, to maintain a constant dust pickup in a kiln sized by Formula (1), only the velocity gradient of gases in a set of kilns must be constant.

The following equations indicate how this purpose can be achieved: cubic feet of gases per min. $= oQ_s$, and $v = (4)$ cu. ft./min./πD^2 so, at a constant velocity, $Q_s = vD^2$.

The maintenance of a constant velocity insures that the heat transfer by convection remains the same and, in some cases, improves the accuracy of Formula (1). It will be noticed that use of Formulas (1) and (2) results in a proportionality of diameter and length. This formula would be

$$D = x/yL$$

In the kiln-sizing formula presented by Martin, the diameter is proportional to the length and, by the foregoing analysis, the terminal speed of gases and the rate of gases per ton of material are constants.

Formula (3) can be derived from the fact that production per day is equivalent to the weight of dry material in the kiln, at any instant, times the number of complete changes of material in a day. These relations are:

Weight of material $=$
$a_s \times L \times$ lb. per cu ft./2,000,
Number of passes $= 1{,}440/t$, so
$Q = a_s \times L \times 1{,}440/t \times$ lb. per cu. ft./2,000

The cross-sectional area is proportional to the diameter squared at optimum tonnage per day, so

$$Q_d = pDFL/t$$

This equation becomes Gibb's formula at a constant retaining time. The time in minutes for travel of a charge through an unrestricted kiln is expressed as:[5]

$$t = 0.037\ (\alpha c + 24)\ L/DNS$$

If N, the slope of the kiln, is maintained constant; since αc, the sliding angle, is a constant for any material, then

$t = xL/DS$, substituting, $Q_d = kD^2S$

The formula for kilns having dams would be rather involved. Reference can be made to equations simplified by Bayard[4] in these cases.

Formula (4) is an approximation derived from Formula (1) and generalized relationships between heat economy and surface area. The fuel usage per ton in any kiln depends on the surface and contact areas of material, the coefficients for radiant and convection heat transfer, and the temperatures of gases, refractory and charge. The final temperatures and production of the charge through a kiln remaining constant, an increase in dimensions, although causing a linear increase in heat-transfer area, also affects heat transfer by changing the velocity of gases, lowering the differential temperatures because of lower rates of gases with improved fuel economy and, in the case of an increased diameter, improving the emissivity of the gases by changing the beam length (the average length of a beam of radiation from the gases).

Although it is evident that the relationships between the variables are too complex for exact mathematical treatment, several generalizations can be made. As a kiln becomes more efficient through added surface area or heat reclamation devices, the exit temperature of waste gases decreases and the effectiveness of added surface area diminishes. Fuel economy is a function, therefore, of the heat available in the waste gases which is related to their temperature. Formula (4) expresses these generalizations as a simple approximation, relating fuel usage to the reciprocal of the term DL raised to a power θ, which varies in some proportion to the temperature of waste gases. The factor θ can be determined approximately if two kilns of different dimensions can be operated at the optimum production rate of the smaller kiln. The speeds should be adjusted so that the surface areas of material are proportional to the diameter-length product.

Two kilns of different dimensions were adjusted to produce the same tonnages with the following results:
For Kiln A:

$DL = 810$ ft.

Natural gas consumption (CHF at equivalent tonnages)

24,000 (experimental)

For Kiln B:

$DL = 940$ ft.

Natural gas consumption (CHF at equivalent tonnage):

22,000 (experimental)

The consumption calculated for the value $\theta = 0.6$ was 21,800.

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The Plant Notebook

Edited by Theodore R. Olive

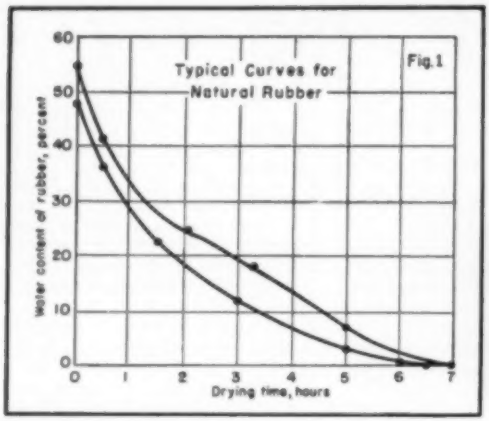


Fig. 1—Typical drying curves for natural rubber, using a mixer of the type shown in Fig. 2 as a vacuum dryer.

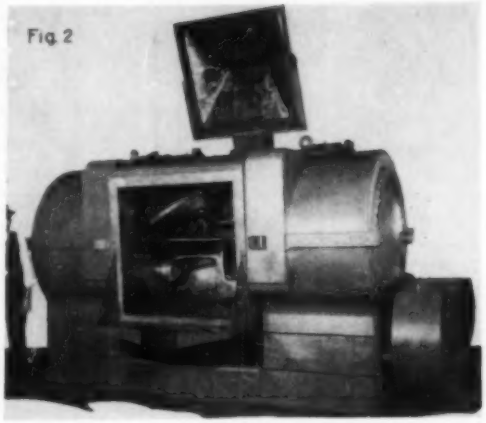


Fig. 2—This Patterson Kneadermaster mixer is typical of heavy duty mixers that can be used for rubber drying.

How to Dry Rubber in a Double Arm Mixer

ANTHONY P. MASSA, *Project Engineer and Production Supervisor, Stein Hall & Co., Long Island City, N. Y.*

★October Contest Prize Winner

A novel method of drying either synthetic or natural rubber coagulum after coagulation and washing is by the use of a jacketed heavy-duty mixer operating under vacuum. Although this method is a batch operation, the initial cost of the equipment and accessories is much less than for a continuous belt dryer. In addition, the floor space taken up by such a mixer is smaller than for the belt dryer. Similarly, a tray dryer having an equal daily capacity of dry rubber output would take more floor space and cost as much as a jacketed heavy-duty mixer.

The principle involved in the drying operation is that the water contained in the rubber can be boiled off at a much lower temperature than would be possible in other types of atmospheric dryers. The large difference in temperature between the steam jacket and the contents of the mixer during the drying operation causes a relatively large transfer of heat, resulting in greater quantities of water evaporated during the cycle when compared to dryers operating at atmospheric pressure.

Rotary dryers, whether operated under vacuum or not, cannot be used to dry materials like synthetic or natural rubber because the nature of the drying process is such as to make this method inefficient. When such dryers are used, there is an initial period of rapid drying during which water is dried from the surface of the rubber leaving a "skin" of relatively impenetrable material. This does not allow diffusion of water from the wet core to take place readily. Hence, a long period is required before complete drying of the core takes place.

With the use of a jacketed heavy-duty mixer this difficulty is eliminated. The steam in the jacket and the cored blades allows heat to reach all parts of the batch. At the same time, the masticating action during the kneading operation continuously exposes wet rubber to vacuum drying. The kneading operation squeezes water out of the rubber crumbs and, at the same time, exposes them to direct contact with the jacket walls and mixer arms. This action results in efficient drying and reduces the time required for the operation.

Production runs with natural and synthetic rubber show that the characteristics using this drying method are as depicted in Fig. 1. A suitable mixer is shown in Fig. 2.

★November Contest Prize Winner

"Simple Constant-rate Feeder Can Throttle Down to Drops per Minute."

A prize of $50 in cash will be awarded to T. Shaw, chemical engineer, Nkana, Kitwe, Northern Rhodesia, Central Africa. Mr. Shaw's prize winning entry will appear in the January issue.

$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the December winner will be announced in January and his article published in February. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published at space rates if acceptable.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible.

Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries. Also, novel means of presenting useful data are acceptable. Address: Plant Notebook Editor *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

Production-size heavy-duty mixers are built in capacities of 100 to 2,000 gal. In these tests a 400-gal. working capacity mixer was used under a vacuum of 26 in. Hg. With 20 psig. steam on the jacket and in the cored sigma-type blades, this mixer was able to dry 2,400 lb. of wet rubber originally containing 50 percent water in 5-7 hr. For this purpose it used 150 hp., except during the last half hour, when the load increased approximately 10 to 15 percent.

Here's Help if You Need to Write Technical Reports

JOHN B. GREGORY, *Frederick S. Bacon Laboratories, Watertown, Mass.*

Although there are many articles and books on report writing, these published sources seem to lack conciseness. The form discussed here is one we have developed over a period of years. Chief sources are Nelson, "Writing the Technical Report," McGraw-Hill, 1940, and a talk by Prof. Roy P. Whitney of MIT in March 1944.

Those who write technical reports—researchers, development men and engineers—should keep notebooks or other records of the work in clear and complete enough form so that any intelligent person familiar with the field could write a report therefrom. These must be kept as the work proceeds, not written up afterward. They should contain a statement of the object of the work, the procedure, the results and the conclusions.

Developing a Report—First step is to assemble and analyze the data, usually by going through the records and summarizing the information in table form. Then prepare an outline, showing organization, topics to be discussed, major and minor subdivisions, and decide whether and how graphs and drawings should be used. In the finished report it is desirable to reserve each graph or drawing for a single study. If these are lengthy and are likely to be used again, their procedures should be given in a separate table, with essential details in notes to the table. Interpretive material should be in "remarks" rather than in the notes, if needed. Background information such as materials sources and equipment listings should be complete enough to permit another to reproduce the data. After the outline a preliminary draft should be written, which is then revised with regard to good English, clarity, logical arangement, brevity and relevancy. This should be as desired in the final copy.

Report Form—In general, a report should have preface, table of contents, a summary, introduction, theoretical or background discussion, experimental or engineering procedure, discussion, conclusions, recommendations, and suggested future program.

1. *Preface*—This contains the salutation, subject of report, statement of whether a final or progress report, period covered by report and details of the report authorization including dates, times, places, persons and methods of communication.

2. *Table of Contents*—May not be needed in a short report and in a long one may precede the preface. If the report deals with several essentially independent subjects, it should be in separate parts, each treated as a sub-report and self-contained.

3. *Summary*—This section is designed for the policy-making executive and so should be complete, but not detailed. It is the most important part of the report since it distinguishes the forest from the trees. It includes object, results, conclusions and recommendations.

4. *Introduction*—This begins the detailed report, discussing the overall and immediate objectives and relationship between short- and long-range objectives. It includes the historical data such as events leading to the problem, literature search, survey of previous or related reports.

5. *Background or Theoretical*—Analyses problem, lists specifications to be met and outlines work needed to accomplish the objective.

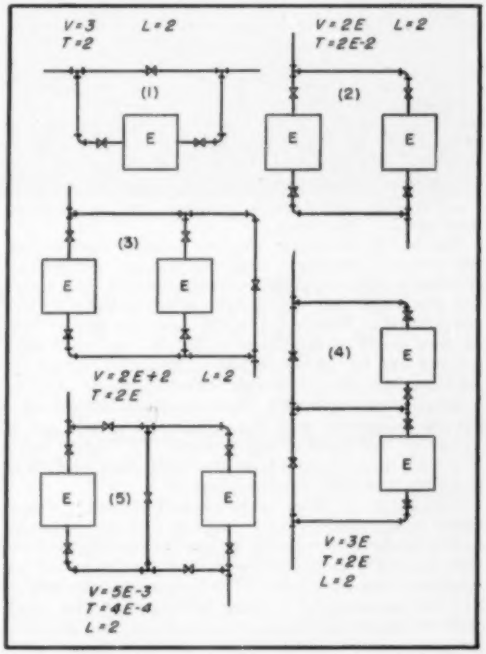
6. *Experimental*—Gives enough detail to permit work to be duplicated by others. It is best to summarize in the body of the report, with details in tables, figures and appendices. Includes details of materials and equipment; procedure (with enough facts to allow readers to judge accuracy and precision of results); and results, without opinion or interpretation. Reports both positive and negative results, well organized, with tables, figures, photographs, etc.

7. *Discussion*—Next to the summary in importance. Evaluates and interprets data and shows relationship between results and conclusions.

8. *Conclusions*—Should be stated clearly and briefly.

9. *Recommendations*—Based on the conclusions.

10. *Future Work*—If not a final report. Program should be outlined.



How to Prevent Use of Too Many Fittings

MAXEY BROOKE, *Sweeny Refinery, Phillips Oil Co., Sweeny, Texas.*

It is told of the Swiss mathematician Euler that, in trying to solve the famous Koenigsberg Bridge problem—insoluble, as it developed—he laid down the basis for a new branch of mathematics, topology. Roughly the theory of the properties of invariants during transformation, topological speculations are ordinarily in the stratosphere of

higher mathematics. But it happens that a part of this theory can be applied to everyday problems—very practical problems in insuring that in a piping layout no more than the minimum number of fittings needed will be used.

Two incidents led to our application of some elementary principles of topology. In the first case three pumps were to be manifolded so that any one could be used independently, yet any two or three could be used in series. It was necessary, too, that the layout permit any pump to be cut out for repairs without effect on the other two. Although the manifold design chosen was checked by several engineers, a few weeks after the installation was finished it became apparent that two unnecessary valves had been used. They were 8-in. high-pressure alloy valves, so several hundred dollars had been spent uselessly.

In another case a bench model catalyst tester was designed with two catalyst chambers hooked up to run independently, or in series with either chamber preceding the other, or in parallel. The money involved wasn't great but compactness was essential and 25 or 30 man-hr. of design time was spent in developing the piping arrangement.

These two cases of wasted time and money caused the development of a number of formulas which would enable an engineer to tell immediately whether or not the minimum number of valves and fittings had been used.

The drawing shows five common cases of equipment hook-ups, all but Sketch (1) being for two or more pieces of equipment labeled *E*. Under each appears the formula showing *V*, the minimum number of valves, *T* the number of tees, and *L* the number of elbows. Of course, many variations of these basic designs are possible, while in many cases angle valves can be used to eliminate some or all of the tees.

Sketch (1) shows the simplest possible case, having one piece of equipment with a bypass, an arrangement commonly used with control valves and meters. It is amazing how often this arrangement is assembled with too many fittings. Sketch (2) is the common case of two or more pieces of equipment in parallel, set up so that any one can be cut out without interrupting operations. An example is filters in a water softening system. Adding a bypass produces Sketch (3), an example being a two-cylinder compressor with the cylinders in parallel and a bypass to regulate discharge pressure. The bypass valve is often a pop valve. The minimum number of fittings is seldom seen with this arrangement.

Equipment in series with bypasses—Sketch (4)—is often encountered in heat exchanger design, although unfortunately the bypasses are sometimes forgotten so that an entire exchanger bank must be taken out of service to clean a single one. The last arrangement, Sketch (5), is a series-parallel hook-up, often used in pilot plant work to permit two or more units to be run in either series or parallel. Readers may note that Sketch (5) could be operated with one less valve, but this is true only of the two-unit hook-up. A three or more unit assembly follows the formula.

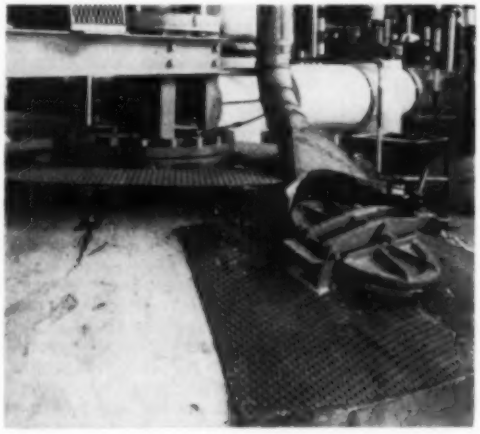
We Repaired an Oxygen Plant Valve Without Disassembly

R. J. Akot, *Chemical Engineer, Overseas Gas Corp., Manila, Philippines.*

In our oxygen plant we experienced a difficulty that had not been encountered in six other plants of like design. The expansion valve on the oxygen rectifying column developed a worn seat which resulted in erratic column pressure lowering, and effectively put a stop to production. It was the manufacturer's recommendation that we break into the column casing and go through 12 in. of insulation in order to remove the valve for regrinding. Instead, we decided to regrind it in place.

The valve stem operates through an extension pipe which passes through the insulation and is packed by a packing box outside the casing. This meant that access to the valve seat required long-handled tools. It also meant great care in preventing oil from getting into the valve, since oil and oxygen don't go well together. Therefore, I took some carbon tetrachloride solvent and extracted the oily vehicle of the grinding paste, replacing the oil with glycerine to form a pasty mass. The valve plug was then ground against the seat, using this modified grinding paste. After each grind we swabbed the seat with a bit of clean gauze moistened in solvent and held on the end of a piece of wire inserted through the extension pipe. As soon as a good seat was attained, air blown through the valve expelled the solvent vapor and any grinding compound that was left after the wiping.

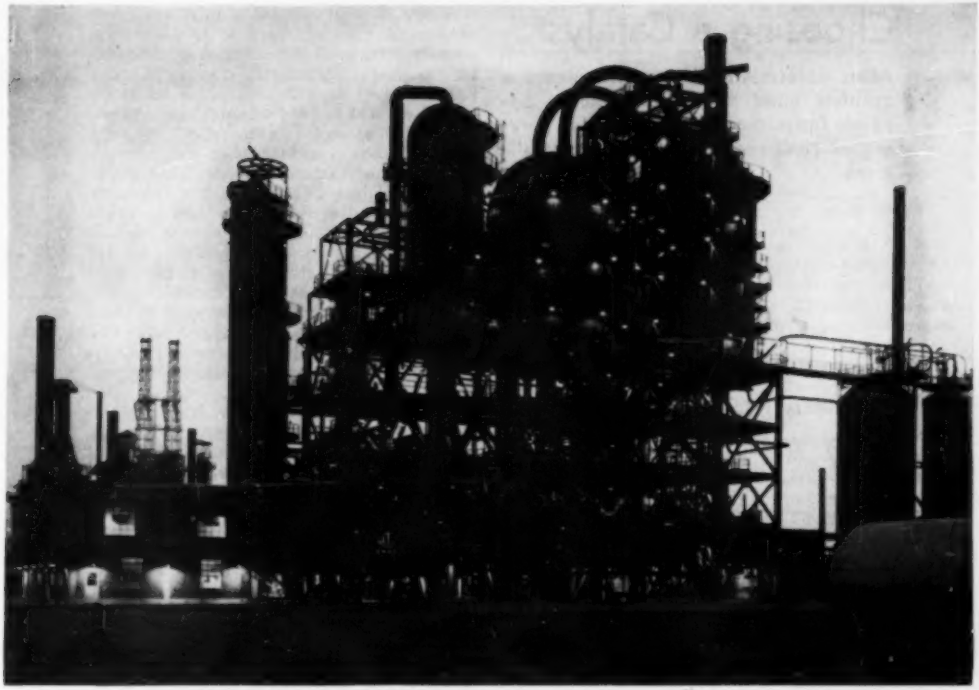
The result was a perfectly satisfactory repair which required only about 8 hours down time and the services of two mechanics, compared with an estimated loss of 120 hours of productive time if we had followed the usual procedures.



Don't Force Plant Operators to Walk on Insulation

Thermal insulation is intended to cut heat losses; it's no secret that it isn't much of a walking surface. Furthermore, to make sure that it is not damaged accidently, it's best to isolate it from possible harm.

One Pennsylvania chemical concern solved the problem of access to the manhole and drive of a large reaction kettle by the use of skid-proof metal plates, as the illustration shows. The kettle, operating at 550 deg. F., is covered with 3 in. of mineral wool blankets, finished with insulating cement. Formerly the operators braced their feet against the insulation in removing the manhole cover. The extra cost of the metal plates was a small factor compared with the maintenance that was saved by this simple improvement.



Cat crackers such as this Cities Service unit are large consumers of catalysts.

CATALYSTS

Although we don't know much about how catalysts work, we are placing ever greater demands on them. Measure of their importance is the rise of a sizable industry just for their manufacture—$30 million for cracking catalysts alone.

CHEMICAL ENGINEERING REPORT—DECEMBER 1951

As you will note, the following pages in this report on catalysts deal with three phases of the subject: their selection, manufacture, and recent industrial applications.

How they work

You will probably also note there is no section devoted to how catalysts work. Although strides have been made toward putting the selection of catalysts on a scientific basis through an understanding of how they work, empirical methods are still used for the most part, with the aid of knowledge gained from previous experiences under similar conditions.

Recent advances in the theory of catalysis, however, indicate the day their selection will be made on a scientific basis is not far off. This will undoubtedly pave the way for new and improved processes, more and cheaper chemical products.

Electron concept

The newest approach pays attention to the electron-donating and electron-accepting properties of catalysts in relation to the catalytic activation of the reactants. Until recently, the catalyst has been considered as an adsorbent which holds the reactants in a favorable geometric position so as to permit the reaction to occur—with little attention given to the interaction between catalyst and reactant.

Now let's get on to what Dr. Hoog of Shell Oil has to say about how to choose a catalyst according to the best methods available to us at this time.

Choosing a Catalyst

After determining the requirements a catalyst must meet, development depends largely on much laborious varying of components and process conditions.

H. Hoog

Contact (or solid) catalysts are predominant in the chemical industry, and it is this type that we are concerned with here.

What it involves

Finding a catalyst for a given job involves (1) knowing what requirements must be met and (2) developing a catalyst to meet these requirements.

REQUIREMENTS FOR A CATALYST

The requirements a catalyst must meet are activity, selectivity, adequate lifetime, and mechanical strength.

Activity of the catalyst determines the size of the reactors needed for a given yearly production. Its selectivity determines the amount of base material lost by objectionable secondary reactions. Its lifetime fixes the cost of replacement by fresh catalyst needed for a given production figure. Mechanical strength is primarily of significance in designing equipment and may influence building costs. Secondarily, it may affect flow resistance and hence the required pumping and compression energies.

ACTIVITY

An industrial catalyst must be active under conditions in which the thermodynamically determined equilibrium position is favorable. In some cases, catalysts become active only in a temperature range where the equilibrium position at atmospheric pressure would be unsatisfactory. Accordingly, in ammonia synthesis, methanol synthesis, and hydrogenation of hydrocarbons, pressures of several hundreds of atmospheres have to be applied.

Activity example

A typical example is the hydrogenation of strongly-branched octenes to iso-octane. In some plants (I.G. Farben design) a Ni-W-S combination is used at 250-300 deg. C., in others a Ni-majolica catalyst at 150-200 deg. C. (Shell Development design). In the former case pressure has to be at least 100 atm. for complete saturation, in the latter several atmospheres are sufficient.

SELECTIVITY

As a rule, a given base material can be worked up to several final products. And it is the very essence of catalytic chemistry that by choosing the right catalyst we can select the best reaction.

DR. IR. H. HOOG *is Associate Director for Process Research and Development, Koninklijke/Shell-Laboratorium, Amsterdam, Holland.* *This article is based on his paper presented before the Chemical Engineering Group, London, Dec. 12, 1950.*

A very eloquent example is found in a study of catalytic cracking.[1] Here it is shown that several materials, all with a very large accessible surface, greatly accelerate the cracking of hydrocarbons. However, with each of the substances used (activated carbon, activated alumina and a silica-alumina-zirconia combination), the yield-structure differs completely (Fig. 1).

Whereas, over activated carbon, n-hexadecane is converted into an entire range of fragments, with no special predilection for any particular molecular size, the silica mixed catalyst produces a remarkably large yield of C_3 and C_4, and that of C_6 and C_7 is also relatively large. In this respect activated alumina is between the two.

Production distribution is also quite different from that in purely thermal cracking when CH_4 and C_2 are preponderantly formed. There are many other differences; for instance, as regards degree of saturation.

Directing effect

It is this directing effect that makes a catalyst important, and in practice we only speak of catalytic cracking when the kind of yield-structure produced by the silica-alumina-zirconia catalyst is met. This is the reaction producing a maximum yield of high grade gasoline hydrocarbons.

In ammonia oxidation, the yield of nitric can be increased by using an alloy of platinum rather than platinum itself.[2] With an increasing rhodium content and otherwise constant conditions efficiency of conversion is raised. We are here concerned with the competitive reactions:

$$NH_3 + O_2 \rightarrow NO + H_2O \text{ and}$$
$$NH_3 + O_2 \rightarrow N_2 + H_2O$$

Apparently, the inclusion of rhodium affects the selectivity of the catalyst. Another effect is also observed: evaporation or erosion of the catalyst gauzes is greatly diminished by the use of a rhodium alloy.

Methanol oxidation

The requirement of selectivity is so important that we submit a third example. The oxidation of methanol to formaldehyde, like that of ammonia just discussed, is a reaction that can be performed over metal catalysts. The conversion also involves decomposition of the formaldehyde, while CO is formed, and total oxidation to CO_2. Of course it is essential to suppress the latter reactions as far as possible and to encourage partial conversion. Though both silver and copper as metals are catalysts for this reaction, silver is found to be far more selective, the ultimate yield of the reaction being much higher with the latter material.

The oxidation of ammonia and methanol are both very rapid reactions, the reaction time being of the order of 0.01 sec. Consequently, practically no time is available for diffusion into the inside of a porous catalyst mass.

For this reason metals in the form of gauzes or a thin layer of granular material are preferred.

LIFETIME

Even when a catalyst is active and selective, not all the conditions that must be fulfilled in industrial practice are complied with.

Why it's important

The third requirement, equal in importance, is adequate lifetime. In the case of a material like platinum this condition is obvious. But even with relatively inexpensive material we cannot afford to remove the catalyst from the re-

What to consider when selecting catalysts . . .

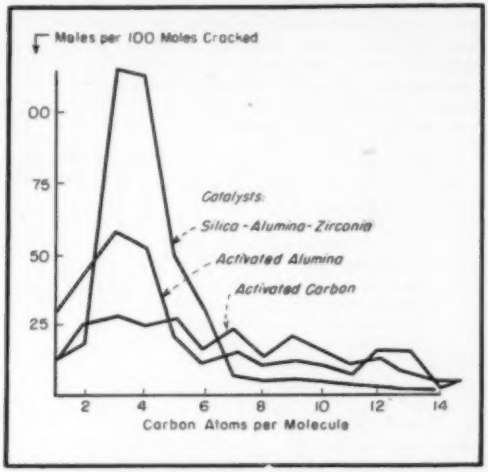


Fig. 1—CATALYST CHOICE AFFECTS NATURE OF PRODUCT. Catalytic cracking of n-hexadecane.

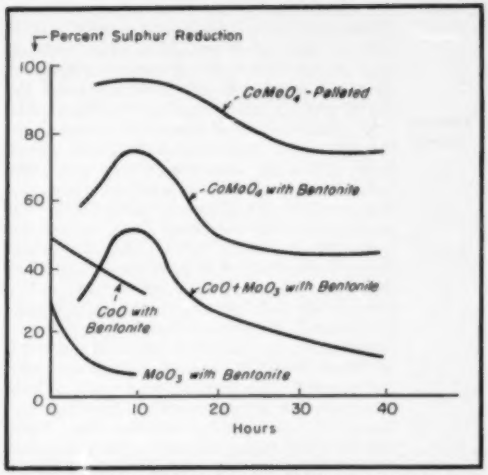


Fig. 2—COMBINATIONS OF ACTIVE MATERIALS BOOST YIELD. Hydrodesulphurization of gasoline.

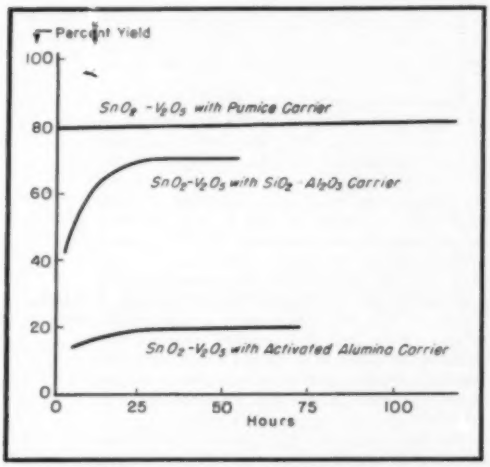


Fig. 3—"INERT" CATALYST CARRIERS ALSO AFFECT YIELD. Oxidation of naphthalene to phthalic anhydride.

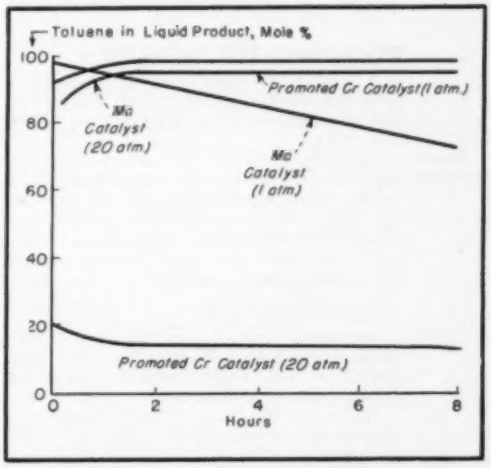


Fig. 4—REACTION PRESSURE MAY AFFECT CATALYST CHOICE. Dehydrogenation of methylcyclohexane.

action chamber after it has been in use for only a short time. Any interruption of a continuous process—and a continuous process is generally the most economical in the chemical industry—is costly, and for that reason if no other the lifetime of the catalyst should be reasonably long.

High yield per unit

Accordingly, catalysts used for industrial purposes either (1) have a lifetime of several thousands of hours, or to express it by different standards, give a high yield of product per unit of catalyst, or (2) they must be able to be regenerated on the spot by simple means, so that its total lifetime, again, is very long.

As regards the last point, there are several processes in the oil industry with alternate chemical reaction and regeneration of the catalyst. Usually, the removal of carbonaceous material from the catalyst is necessary.

MECHANICAL QUALITY

The fourth factor of importance in industrial catalysts is the mechanical quality of the contact material.

Pulverizing

We have seen that in the case of very rapid reactions gauzes or thin layers of granulated metal can be used, so then a definite shape is involved. Generally, however, the contact material is put into reactors in more or less high beds and it is possible that the pressure of the charge pulverizes the bottom layers. This greatly in-

creases the resistance that confronts the reacting substances flowing through the chamber, which is to be avoided at any cost. It must then be decided whether it is possible to give the catalyst sufficient mechanical strength to allow its being used in one high bed without pulverizing, or whether less strength will be tolerated and the reactor divided into several beds by using grids.

Minimum strength

It is difficult to give figures for the minimum strength that a technical catalyst pellet should have. Moreover, requirements vary for differently constructed reactors and the companies concerned are not all equally stringent in their specifications. On the whole it may be said that really strong catalyst pellets need a crushing strength of at least 10 to 20 lb. per pellet. In an abrasion test in which the catalyst is rotated in a kind of ball mill, the catalyst may not produce more than 2 or 3 percent of dust in an hour.

Sometimes regenerative processes make it necessary to give the catalyst a particular shape and strength. The fluid catalytic cracking technique requires catalyst particles of certain size (about 20-120 microns) and that they should also be fairly strong, or preferably, round and strong. These are very special requirements for shaping. It has even been possible to make a material consisting of microscopically small sphericles, known as micro-spheroidal catalyst.

DEVELOPING THE CATALYST

Developing a catalyst is in the first place a matter of intuition and experience, but also of theoretical knowledge and usually a good deal of trial and error.

Previous experience

Generally, from our own and other people's experience[2] we can say what materials are likely to be catalytically active for a given reaction; selectivity is often more difficult to predict, as is lifetime. The final design or formulation is generally found only after much laborious varying of components and processes.

VARYING OF COMPONENTS

As a rule industrial catalysts do not consist solely of active material, but have other components as well. Various cases of such mixed catalysts may be distinguished.

In the first place a catalytically highly active material may be used together with a catalytically inert material. The latter can rightly be called a carrier, and it may have various functions. As the active material is very expensive, it may be desirable to admix a cheaper material to make it easier to handle. Or it may be for shaping.

Non-ideal

But generally, the carrier does not meet the idealized conditions and does have some effect on the behavior of the active constituent of the catalyst. The result may be that the same total effect is achieved with considerably less active material (sometimes because the latter is spread out over a large accessible area). It is also possible that addition of a second component greatly prolongs the life of the catalyst.

How greatly the nature of the carrier may affect the total activity of the mixed catalyst was revealed in a study[4] of Ni-on-diatomaceous earth catalysts. Reaction between the nickel component and silicate of the carrier material was found to promote nickel hydrosilicate-type materials in the catalyst, which were presumably essential to high activity.[5] Starting from these findings, we later succeeded in producing active and long-lived Fischer-Tropsch synthesis catalysts, in which the active component was intentionally combined with SiO_2. The siliceous carrier could thus be altogether dispensed with and carriers more suitable for preparing mechanically strong pellets could be introduced.

Mixtures, compounds

Another example of the importance of correct catalyst composition[6] shows (Fig. 2) that both CoO and MoO_3 are active substances for the hydro-desulphurization of gasolines, but that a combination is more active, while a peak effect is obtained not by simply combining CoO with MoO_3 and the carrier physically, but by using the chemical compound cobalt molybdate. Our own experience fully bears out this mutual effect of CoO and MoO_3, and we have actually found that in cobalt-molybdena alumina catalysts, used either for the hydro-desulphurization of gas oil or for the hydro-saturation of butylene dimers, the ratio of cobalt to molybdena pronouncedly affects activity. Optimum activity was reached in catalyst preparations containing considerably less cobalt than molybdenum (on an atom basis). Catalysts of this type are extremely rigid and have a surprisingly long life.

Effect on selectivity

Use of a second, or more, components may also considerably affect the selectivity of the reaction process, so that again more of the desired product is obtained.

From our own experience (Fig. 3) we give as an example the oxidation of naphthalene to phthalic anhydride, the active material chosen being a combination of SnO_2 and V_2O_5. When this active material was used with activated alumina, an extremely active catalyst causing oxidation at as low as 340 deg. C. was obtained. But it had the great drawback that 80 percent of the naphthalene fed was oxidized to CO_2 and H_2O and only 20 percent to the desired product.

Substitutions

Substitution of a cement-like material, consisting of SiO_2 and Al_2O_3, with a considerably smaller surface than the activated alumina, produced quite different results. Though the combination was less active (reaction temperature about 385 deg. C.), it was far more selective (about 70 percent partial oxidation).

The best result was produced by a very common carrier, notably pumice, the selectivity being 80 percent. Its life was very long.

In the usual I.G. Farben process, an efficiency of as much as 86 percent was obtained and the catalyst had a life of many years. This effect was achieved by adding K_2SO_4 to a V_2O_5-on-silica gel catalyst. The activity is then considerably reduced, however, and a lower throughput of naphthalene must be used.

There is not really a good name for the constituents of such multi-component catalysts. The distinction between active material and carrier is rather vague. We suggest the name activating carrier in such a case.

VARYING PROCESS CONDITIONS

A factor that fixes the choice of catalyst is the response of a given catalyst combination to the reaction conditions applied. By ignoring this ele-

ment we would reach completely wrong conclusions.

This may be illustrated by a study[1] on the conversion of paraffins and naphthenes into aromatics. It is known from some Russian work, as early as 1936, and also from our own investigations that Cr_2O_3 and MoO_3 are active catalysts, both for dehydrogenating hydroaromatics to aromatics and for the cyclization of paraffins to aromatics. A comparison of a promoted Cr_2O_3-Al_2O_3 catalyst with a MoO_3-Al_2O_3 catalyst is entirely to the advantage of the Cr_2O_3 combination when the reaction is carried out at atmospheric pressure, but completely disqualifies it when working at 20 atm. (Fig. 4).

Pure compounds

The process engineer cannot base his work on model experiments in which pure *n*-heptane and pure methyl cyclohexane are used as base material. He will soon find that with actual gasoline charge stocks, working at atmospheric pressure, there will be a rapid deterioration of activity owing to poisoning by the five-ring naphthenes (cyclopentane homologs) present. It might be expected that this poisoning could be suppressed by using hydrogen pressure and it was therefore advisable to carry out all the catalyst research work in this field under a certain hydrogen pressure, so that the process engineer's requirements could be met. Consequently, in actual practice the hydroforming process is invariably carried out under hydrogen pressure and, not over a Cr_2O_3-Al_2O_3, but over a MoO_3-Al_2O_3 catalyst.

However, as long as combinations of Cr_2O_3 and Al_2O_3 are used that contain 50 percent or more of the active material, instead of 10 percent as in Greensfelder's catalysts, cyclization catalysts are obtained which remain active under hydrogen pressure and cause satisfactory conversion. This Cr_2O_3 catalyst gives such an excellent combination of the various effects discussed above, that it is worth describing here.

By not using pure Cr_2O_3, but co-precipitating the Cr_2O_3 with Al_2O_3, a catalyst structure is obtained that has considerably higher activity combined with much greater thermostability. The Al_2O_3 in this catalyst certainly has not merely the function of an inert diluent. Though it has the dispersing effect of a carrier and affects the mechanical properties of the ultimate catalyst, it can not be called a carrier in the narrower sense, but is a typical activating carrier.

Addition of promoter

Addition of alkali salts to the Cr_2O_3-Al_2O_3 combination, whatever the ratio of the components, invariably causes relatively low activity at first. But if the experiments are continued long enough, there is unmistakeable induction of the reaction and a higher and broader activity-maximum is obtained. And, when the average activity during a longer operational period is recorded, it is found that the presence of alkali causes a marked increase in this average. This effect is at a maximum when 12 atoms of K are added per 100 atoms of Cr. Therefore, considering that the alkali concentration in the ultimate catalyst did not amount to more than a small percentage by weight, we feel we are justified in calling this component a promoter.

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Catalyst Manufacture

Catalysts are made into various shapes to suit process conditions. Manufacture of synthetic bead and microspheroidal cracking type is unique.

A large majority of industrial catalysts fall into two main groups, preformed catalyst (catalysts that have to be made into special shapes before using) and catalytic chemicals. Examples of the latter are anhydrous hydrofluoric acid, aluminum chloride anhydrous, antimony trichloride anhydrous, boron trifluoride, and boron fluoride ethyl ether complex. These do not require mechanical processing to make them effective for the particular operation to which they are put. In other words, in the case of the solids listed above, the particle size as determined by the particular chemical processing technique employed is satisfactory.

Size alteration

Many solid catalytic materials, on the other hand, are not suitable for use without some size enlargement or size reduction. Catalysts to be used in packed bed reactors, for example, have to be agglomerated to pellet size to meet the requirements of good tower packing such as low pressure drop, large exposure of reaction surface, uniform packing, etc. Other catalysts must be ground to fine powders; e.g., for use in liquid phase reactions such as the hydrogenation of oils and fats.

The common shapes given to preformed catalysts and catalyst supports are pellets, rings, spheres, granules, and powders. Generally the structure is highly porous. This is desirable since much of catalysis depends on adsorption which is a surface effect.

Supports

In a great number of cases, where finely dispersed catalysts are used, it is advantageous to deposit the catalyst on the porous surfaces of an inert support, which has first been formed into the desired shape. There is a growing need for catalyst supports which are chemically inert, mechanically strong, and abrasion resistant. Crushing strengths of the various shapes produced vary from 5 to 600 lb. per pellet, depending on size. Bulk densities range from 35 to 90 lb. per cu. ft.

A support should be chosen that does not react too intimately with the catalyst deposited on it under the reaction conditions—otherwise the catalyst becomes deactivated too fast. When preparing supports from natural materials such

as diatomaceous earth, pumice, clays, porcelain, gypsum, cement, and similar products, it may be necessary to remove soluble substances which may readily react with the catalyst to be deposited. When supports are used at higher temperatures, refractory oxides are generally suitable. Among the newer developments are aerogels which yield supported catalysts of low apparent density, and catalysts supported on synthetic organic high polymers.

Catalyst deposition

Methods for deposition of catalysts on supports are summarized as follows: Surface deposition—(1) precipitation of the catalyst, (2) electroplating, (3) coating with a paste, and (4) deposition of colloidal metals in which the spreading of the reduced metal in nascent state takes place. Internal deposition (uniform distribution of the catalyst throughout the carrier, the internal surface being coated)—(1) permeating or impregnating porous supports with a salt solution and (2) simultaneous precipitation of oxides or mixture of oxides.

Alumina catalyst supports available from one manufacturer are in the form of spheres, pellets, and rings. Spheres vary from $\frac{1}{4}$ to $\frac{3}{4}$ in. diameter, pellets from $\frac{1}{4}$ in. diameter by $\frac{1}{4}$ in. long to $\frac{3}{4}$ in. diameter by $\frac{3}{4}$ in. long and the rings from $\frac{1}{8}$ in. inside diameter by $\frac{1}{8}$ in. long by $\frac{1}{32}$ in. outside diameter to $\frac{1}{2}$ in. inside diameter by 1 in. long by 1 in. outside diameter.

Size and shape

The selection of one size or shape in preference to another is determined by how the supports are used, temperature fluctuation, kind of catalyst, kind of bed, etc. Spheres for surface deposition of catalyst have a network of open pores on the outside surface only; those for an impregnated catalyst have a network of open pores throughout the sphere.

PELLETS

We will first consider the manufacture of pelleted materials. Pellets are one of the most common shapes formed from catalysts or catalyst supports which are later coated or impregnated with catalyst.

Lumps

In the earliest use of catalysts, irregular broken lumps of the catalytic materials were used. It soon became apparent that control of reaction speed and other factors would be much better attained with accurately measurable quantities and uniform physical properties of the catalyst. Moreover, exact ratio of surface area to mass was realized to be of no less importance than total mass in catalytic reactions occurring in packed towers.

Uniformity of surface area plus the advantage of good tower packing led to the development of tableting and extrusion (usually of metal oxides) for making catalyst in pellet form. Some metallic pellets are simply cut or stamped from sheets or sponge metal, but most pellets are formed by tableting or extrusion processes.

Pelleted catalysts for Thermofor and the air-lift type cracking units are usually about $\frac{1}{8}$ in. diam. by $\frac{1}{8}$ in. long. This size has been selected considering pressure drop of gases through a moving bed of pellets, uniform gravity flow patterns of the pellets, distribution of gases through a moving bed of pellets, and allowance of some attrition of the catalyst without necessity for removal of anything but a relatively small amount of fines.

Tableting

Tableting machines turn out as many as 3,500 to 4,000 catalyzer tablets per minute. Some plants have batteries of them for production at the plant site, but their use is more and more for pilot plant consumption. Ready-made catalysts are now the rule for most commercial units.

Some materials must be granulated to make them suitable for compressing. One type of machine rubs dampened materials through a wire screen by the oscillating motion of a roll. It forms agglomerates with a minimum of fines. Granulating mixers are available which blend the ingredients and incorporate in them any necessary granulating fluids. Lubricants are sometimes added to keep the tablets from sticking to the machine. Mixers can be jacketed for incorporating binders that require heating.

The dry granulation technique makes granules suitable for tableting by breaking up lumps of dry powder found by the slugging technique. Slugging makes crude tablets which lend themselves to granulating but are not dense enough for the final tablet.

All tablet compressing operations, no matter what the material, are essentially the same. A measured amount of material is placed in the die cavity and pressure is applied to form it into a tablet of the desired shape and density. However, tableting is not always such a simple operation. The speeds of operation and the size and shape of a tablet that can be made on a given machine vary widely depending on the type of material being compressed, its granular condition, and other considerations such as temperature and humidity. Different materials require different amounts of pressure. Catalyst tableting formulations generally require 10 or less to 100 tons per square inch. Extrusion pressures may be even higher.

Agitated hoppers for feeding materials that tend to bridge or otherwise are difficult to handle in the usual manner are available.

Extrusion

In the extrusion process, pellets of any desired diameter can be produced by using multiple-hole dies with varied hole sizes. These pellets are cut by a rotary high-speed knife at the face of the die.

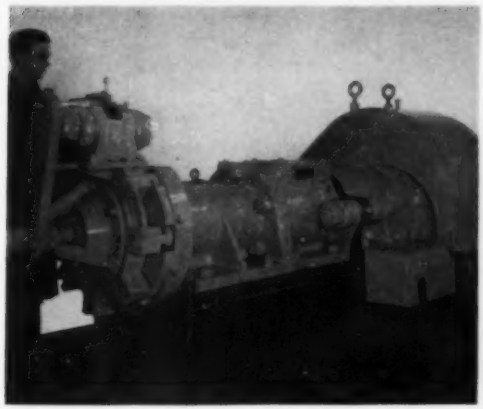
The dual worm feature of some types of extruders provides positive feed at the hopper. Materials are grasped by the counter-rotating worms which eliminate bridging at the hopper and stationary rotation on the worms. Continuous positive feed gives steady extrusion and uniform rates without surges.

1,000 to 4,000 lb. per hr. of clay catalyzer pellets are extruded in one of the newer machines under a pressure of 1,800 to 3,000 psi. The extrusion screw is bored for coolant circulation. The lined an jacketed cylinder has a hinged head which supports the pelletizing die and cut-off mechanism.

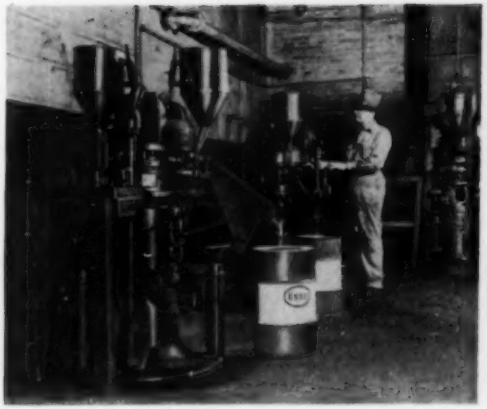
SPHERES

Catalyst or supported catalysts made into the spherical form have in common two big advantages—a minimum of attrition loss and a minimum of resistance to vapor flow. Among

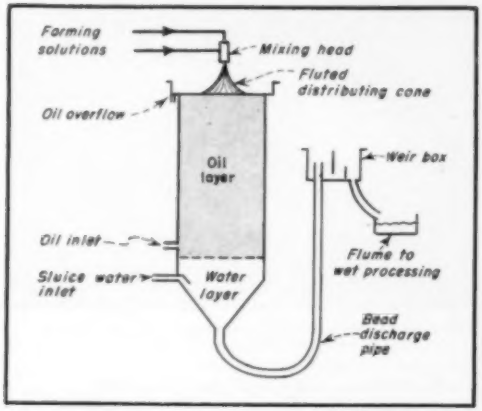
Equipment for making catalysts . . .



EXTRUDING MACHINE



PELLETIZING MACHINES



BEAD FORMING UNIT (for synthetic bead cracking catalyst)

SPRAY DRYER (for microspheroidal fluidized cracking catalyst)

the spherical shapes being used are the synthetic bead cracking catalyst, the microspheroidal fluidized cracking catalyst, clay bead cracking catalyst, and refractory catalyst supports.

Quite often spheres are produced on machines specially developed for this purpose, or they may be formed by rolling a plastic mixture in drums and similar forming equipment.

Bead catalyst

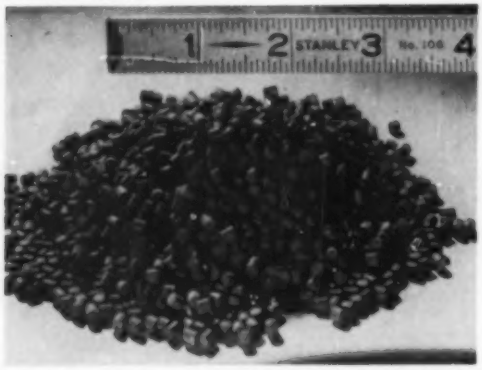
The special technique used for the manufacture of synthetic silica-alumina bead catalyst by the Socony Vacuum Oil Co. is one of the most unusual and unique developments in the field of catalyst manufacture. This catalyst was developed in the early 1940's to take the place of the clay catalyst formerly used in Thermofor catalytic cracking units (moving bed). It is in the form of small translucent, porous beads of extraordinary hardness (average crushing load 200 lb. vs. 30 lb. for a synthetic clay pellet), which are so rugged they effectively resist loss by attrition. They have about a year of commercial life. The increase in yield of aviation gasoline base stock is from 13 to 30 percent. This catalyst is also usable in the Houdry process for cracking gasoline.

Manufacturing the bead catalysts consists of several steps: (1) Preparing the raw materials into two gel-forming solutions, (2) continuously blending the two solutions in correct proportions and forming the blend into separate drops of gel, each of which becomes a bead after further treatment, (3) wet heat-treating, base exchanging, and washing the green beads, (4) drying the treated wet beads by reducing their water content to approximately 10 percent water on the bone dry basis, (5) final drying, followed by tempering the dried beads at elevated temperatures, (6) screening, bulk storage, packaging, and shipping.

Microspheroidal

A more recent development is the microspheroidal type of cracking catalyst, for use in fluid cat crackers. Loss of relatively expensive

Catalyst shapes . . .



PELLETS formed by extrusion (silica gel-vanadia-potassium for phthalic anhydride).

PELLETS made in a tableting machine (magnesium sulphate-platinum for sulphuric acid).

POWDER for use in fluidized system (silica gel-vanadia, for phthalic anhydride).

GRANULES (silica-alumina gel-sulphuric acid for plastics).

catalyst is reduced because of the rounded surfaces.

Spray drying is the key to this process. It provides a more uniform particle size than possible by the earlier method of grinding and sizing.

Hydrogel formation

This catalyst is also silica-alumina. At Davison's new Cincinnati plant, weak solutions of sodium silicate and sulphuric acid are brought together in a special mixer to give a hydrosol which sets in a few minutes to form a hydrogel of silica and water. To introduce the alumina, aluminum sulphate solution is added which impregnates the hydrogel. Aqua-ammonia precipitates the alumina.

Slurry containing silica, alumina, ammonium sulphate, sodium sulphate and other impurities is pumped to a drum-type filter where all surplus liquid is removed. The cake is mulled in paddle-type equipment to give a slurry which is pumpable but which will harden if it is not kept thoroughly agitated. The mulled silica alumina slurry is pumped in equipment capable of developing 5,000 psi. through a series of nozzles located in the top of a spray dryer. The slurry leaving the nozzle is in fine droplets formed by the high pressure and the design of the nozzle. These droplets pass down through a stream of hot flue gases moving in the opposite direction. The exit gases from the dryer pass through water scrubbing equipment to remove any catalyst carried out of the spray chamber. The dried catalyst which discharges from the bottom of the spray dryer must be washed to remove ammonium sulphate, etc. This is accomplished by washing the material on a horizontal vacuum filter. The material discharged from the horizontal filter contains 50 percent water and 50 percent catalyst. This is dried to remove the larger portion of water in a typical direct fire rotary unit which is equipped with cyclones and other auxiliaries that are associated with large rotary dryers. The material leaving this rotary dryer goes to storage and constitutes the spray dried microspheroidal catalyst.

POWDERS

Types of powders

Among the catalysts used in powder form are ground silica-alumina for fluid cat crackers and various metal powders for liquid phase reactions.

Ground fluid cat cracking catalyst preceded the microspheroidal, but is nevertheless still very

much in use because the demand cannot be supplied from the newer plants alone. The time required for manufacture is considerably greater. For example, ground fluid catalyst made at Davison's Curtis Bay, Md., plant requires 72 hr. compared with 5 hr. for the microspheroidal product at its Cincinnati plant. Particles are less uniform in size and, of course, much more irregular in shape.

In this process hydrogel impregnated with alumina is dried in a series of direct fire concurrent rotary dryers. The resulting product has about 1/5 of the volume of the original hydrogel. This dried material is re-washed to remove final impurities and dried a second time. The product is now comparatively free of impurities, contains silica alumina and approximately 10 percent water. It is then ground to a particle size which is suitable for fluidizing in a cat cracker. The equipment for grinding the catalyst consists of a large swing hammer mill, elevators, and sizing equipment.

Metallic powders

Metallic powders are generally prepared by precipitation from solution in the fine state or by crushing and reducing to size in stamp mills.

RINGS AND GRANULES

Rings may be produced by extrusion or tableting (either rotary or shuttle-feed hydraulic machines). With tableting machines, formation of rings requires special dies and core-rod equipment.

Granule formation

Granules are usually produced by crushing larger aggregates or agglomerates followed by screening to the desired size. Probably the largest uses for granule type catalysts are in oxidation (production of ethylene oxide, phthalic anhydride and formaldehyde), and dehydration.

A specific example is the formation of highly-active granule type catalyst for the removal of a small percentage of carbon monoxide (such as 3 percent) from a hydrogen gas. It is necessary to have a highly active catalyst, so that this small amount of carbon monoxide may be completely transformed into methanol.

Such a catalyst is obtained (U.S.P. 1,844,857 and 1,844,129) by melting together pure copper oxide and any oxide of chromium, titanium, molybdenum, zinc, or manganese, breaking up the resulting melt into fragments, and reducing these in hydrogen at 250 to 350 deg. C. The copper oxide is reduced, leaving the metal; the other oxide is unreduced. The granules produced are hard, highly porous, and very reactive at relatively low temperatures. Metallic copper tends to dissipate the heat of reaction, thus favoring its progress.

We are indebted to Earl C. Ray and George Grossman of Harshaw Chemical Co., Cleveland for valuable assistance in the preparation of this article, and to Davison Chemical Co. for catalyst photos.—Editor.

Recent Applications

No major branch of industrial chemistry remains untouched by catalysts. Here are some of their most recent contributions.

SYNTHETIC DETERGENTS

Synthetic detergents are among the important newcomers requiring catalysts in their manufacture.

Alkylation

In the manufacture of alkyl aryl sulphonates, aluminum chloride is the catalyst for the alkylation step (Friedel-Crafts reaction).

The alkyl portion is frequently derived from a kerosene distillate fraction obtained from the refining of paraffinic crudes. This fraction is chlorinated with chlorine gas prior to alkylation. The catalyst is usually iodine.

A second major type of synthetic detergents are the long-chain (C_8 to C_{20}) alcohol sulphates. The alcohols are prepared by the high-pressure catalytic hydrogenation of natural oils with a copper-chromium oxide catalysts, or by low-pressure reduction with sodium hydride.

Oxo

Synthetic olefinic hydrocarbons are another source of alcohol sulphates for detergents. Higher molecular weight olefinic hydrocarbons containing C_{10} to C_{17} are converted catalytically to oxygenated molecules higher in molecular weight by one carbon atom by the newly-developed Oxo process. These are then converted to the corresponding alcohols by catalytic hydrogenation. Alcohols of the proper molecular weight are then sulphated.

RESINS

Development of the newer plastics and resins is being accelerated by catalytically-prepared chemicals such as sorbitol, phthalic anhydride, maleic anhydride, vinyl acetate, and vinyl chloride. Many of the polymerization reactions are aided by catalysts.

Sorbitol

The most rapidly-growing use of sorbitol is in the manufacture of alkyd resins, where it makes a good alternate for glycerin in many cases. This chemical was first produced commercially by an electrolytic reduction process. But nickel-catalyzed hydrogenation of the dextrose feed is now employed. After the nickel catalyst is filtered out, ion exchange and activated carbon purification are used before removal of excess water by evaporation. Atlas Powder Co. has doubled and re-doubled its production capacity for sorbitol since the start of the Korean war.

Phthalic anhydride

Some manufacturers of another alkyd resin component, phthalic anhydride, are using ortho-xylene instead of the conventional napthalene for their source material. Ortho-xylene is coming into prominence because of stepped-up benzene requirements.

This means another catalytic process for making phthalic. The catalyst for the vapor-phase oxidation of either naphthalene or ortho-xylene is vanadium pentoxide. Theoretical yield with ortho-xylene is about 20 percent higher than with naphthalene, but plant results show a smaller pound-for-pound advantage for ortho-xylene over naphthalene.

Since 1946, ortho-xylene has been successfully used by Oronite Chemical Co., the only phthalic

producer on the West Coast. American Cyanamid, at Bridgeville, is the only producer that can operate with either raw material, although its production is derived mostly from naphthalene.

In addition to the usual fixed-bed process, Sherwin-Williams successfully uses a fluid catalyst in a plant making around 2½-3 million lb. phthalic annually. Using an improved vanadium catalyst developed in Germany, this plant claims better heat control and higher yields, although catalyst loss is a problem.

Shortage of phthalic anhydrides for alkyd resins has moved maleic anhydride into the spotlight. Approximately 78 percent of current maleic output goes into synthetic resins—most of this is for alkyds, the remainder for modified alkyds and copolymer laminates.

Maleic These different raw materials for maleic are in use today: benzene, phthalic anhydride, and butenes. Besides these, toluene is a starting point of considerable promise.

In all these processes, the vaporized hydrocarbon is oxidized with air in the vapor phase using a vanadium pentoxide catalyst similar to the type used in phthalic anhydride manufacture. Because of the exothermic nature of the reaction, temperature control is a must, usually being maintained by circulating molten salt or mercury around the catalyst tubes.

Vinyls The recent boom in acetylene chemicals has made possible increased quantities of vinyl acetate and vinyl chloride.

In 1949, 21.3 million lb. of polyvinyl acetate was produced. An additional considerable quantity of vinyl acetate is co-polymerized with vinyl chloride. Polyvinyl acetate is also the starting material for polyvinyl alcohol.

To make vinyl acetate, acetic acid is added to acetylene via a liquid phase process, with mercuric salts as catalyst; addition of a second mole of acetic acid gives ethylidene diacetate.

Vinyl chloride is produced by the catalytic addition of HCl to acetylene in aqueous solution (and competitively by cracking ethylene dichloride). In 1949, production of polyvinyl chloride and polyvinylidene chloride was about 40 million lb.; the total figure for polyvinyl chloride and copolymers (including acetate) was 226.8 million lb. in 1949.

SYNTHETIC FIBERS

Acrylonitrile Production of the new acrylic fibers will be given a boost by a liquid phase catalytic process for combining HCN with acetylene to form acrylonitrile, soon to be carried out commercially by Monsanto in Texas. The newer hydrogen cyanide plants react natural gas, ammonia, and air over a platinum gauze catalyst.

The only present commercial production of acrylonitrile (American Cyanamid) is through ethylene oxide plus HCN to ethylene cyanohydrin and dehydration to acrylonitrile. Indications have been that acrylonitrile can be made more cheaply by the acetylene process.

However, offsetting this to some extent, is a cheaper catalytic process for ethylene oxide by direct oxidation with air recently announced by Scientific Design Co. of New York. A 25 percent reduction in cost and higher yields is claimed. One of the major factors involved is an improved silver catalyst. Originally finely-divided silver on an alumina carrier was used for the oxidation. Other factors reducing the cost in this new process are specially designed equipment, refinements in conditions of reactions and recovery, continuity of operation, and low utilities consumption.

Acetic anhydride Supplies of acetic anhydride and acetic acid for acetate rayon have been boosted by catalytic production of acetaldehyde. Acetaldehyde is made by Carbide and Carbon by bubbling acetylene into an aqueous sulphuric acid solution, with dissolved mercurous sulphate as catalyst (competitive processes are vapor phase oxidation or catalytic dehydrogenation of ethyl alcohol, propane/butane oxidation, or byproduct from the Hydrocol operation at Brownsville, Tex.). Acetic acid is obtained from acetaldehyde by air oxidation with a manganous acetate catalyst. The actual acetylation of cellulose with acetic anhydride uses concentrated sulphuric acid as a catalyst.

Ethylene glycol A striking way to make ethylene glycol which is used in the manufacture of Du Pont's new Dacron fiber is based on a catalytic process. Formaldehyde is reacted catalytically with carbon monoxide and water the resulting hydroxyacetic acid is esterified, and the methyl hydroxyacetate catalytically hydrogenated to form the glycol and to regenerate methyl alcohol used in the esterification.

SYNTHETIC RUBBER

New improved methods for the manufacture of butadiene for synthetic rubber smack strongly of catalysts.

Butadiene A new pelleted calcium-nickel phosphate catalyst ups the yield of butadiene from *n*-butylenes from present 70 to 92 percent. Production from present butadiene plants is raised about 10 percent by simply changing the catalyst, while minor modifications can produce up to a 50 percent increase. And lower-cost butadiene is produced.

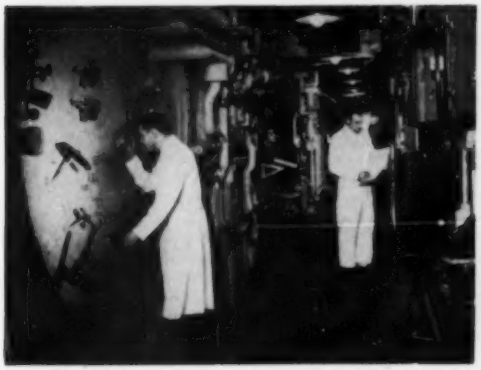
Heretofore the standard catalyst composition was 72.4 MgO, 18.4 Fe_2O_3, 4.6 CuO, 4.6 K_2O. Phillips, Humble, Polymer Corp., and Rubber Reserve are among the petroleum butadiene producers beginning to use the new catalyst, which was developed by Dow and is produced by this company in the form of $\frac{1}{8}$ in. × $\frac{1}{8}$ in. pellets.

Although production of butadiene can be upped merely by substitution of the new catalyst, optimum benefits are obtained by rebalancing the size of the equipment for butadiene recovery. Thus substitution of the catalyst should be accompanied by strengthening the grates supporting the catalyst and additional steam superheating and feed superheating capacity. But no additions need be made to the feed preparation section, the waste heat boiler, water quenching tower, and vapor recovery equipment to get a much higher production rate from the existing plant.

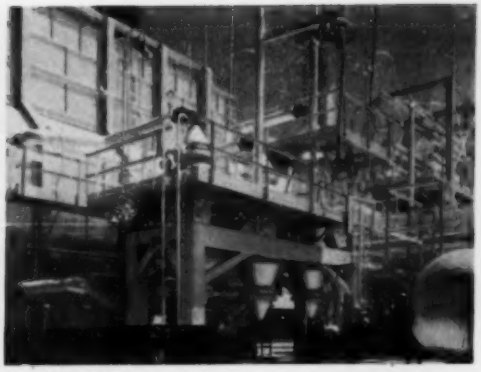
The increased production of butadiene that can be obtained may very well mean a cutback in butadiene from ethyl alcohol required by the synthetic rubber industry. This in turn will mean cheaper synthetic rubber.

At least one new catalytic process for making

These new processes are catalytic . . .



HIGH-PRESSURE ACETYLENE REACTIONS



PLATFORMING

GAS REFORMING (Gasmaco process)

HOUDRIFORMING (Pilot plant)

butadiene from ethyl alcohol has reached the commercial stage. Davison Chemical Corp. has contracted with the RFC to produce a 2 percent tantalum pentoxide—98 percent silica gel catalyst for the condensation of acetaldehyde (produced by catalytic dehydrogenation of ethyl alcohol) to crotonaldehyde.

Crotonaldehyde is an intermediate product which is reduced to butadiene by the tantala in the catalyst, with ethanol acting as a hydrogen donor.

This process is somewhat similar to the original used in the World War II butadiene-from-alcohol plants that have since been re-activated.

From acetylene

Still another fairly recent development is the manufacture of butadiene from acetylene using catalysts. This process was developed in Germany where ethylene is not plentiful. The first step is the reaction of acetylene and formaldehyde to form butynediol (ethynylation). This reaction is carried out under 5 atm. pressure in the largest pressure towers ever built for catalytic processes. Copper acetylide on silica granules is the catalyst. The butynediol is perhydrogenated (copper nickel on silica catalyst, 300 atm.) giving 1,4-butynediol, which is then dehydrated to tetrahydrofuran. This in turn is dehydrated to butadiene using a phosphate catalyst.

Styrene

Styrene, the other main constituent of general purpose synthetic rubber, is made by the dehydrogenation of ethylbenzene with a selective fixed catalyst such as zinc, chromium, iron, or magnesium oxide, on activated charcoals, aluminas, or bauxites. This in turn is made by alkylating benzene with ethylene in the presence of an aluminum chloride or phophoric acid catalyst.

AROMATICS AND AVIATION GAS

In the petroleum field, aside from the increased use of catalysts in cracking operations where catalytic cracking has now outstripped thermal cracking in the race to provide gasoline, attention is centered on the various catalytic reforming operations that have recently come into being.

Five processes

They are five in number: Thermofor Catalytic Reforming, Fluid Hydroforming, Houdriforming, Atlantic Refining Co.'s new reforming process, and Platforming.

The Thermofor catalytic reforming process developed by Socony-Vacuum will resemble the

modern Thermofor catalytic cracking process in providing a moving catalyst bed in the reactor with continuous catalyst regeneration in a separate regenerator or kiln. In this respect it will differ from other reforming processes which comprise fixed-bed or fluidized-bed systems. Like them it will suppress coke deposition by hydrogen recycle to the reaction zone, and will combine isomerization, dehydrogenation, and cyclization to produce high-octane, aromatic-rich reformate to meet current and future requirements for upgrading virgin and thermally cracked naphtha fractions.

Catalyst to be used is coprecipitated chromia and alumina, in bead form. The new strong bead is harder than silica-alumina, used in catalytic cracking. One of its outstanding characteristics as a reforming catalyst lies in the fact it enables coke deposition to be controlled to a low level by a lower partial pressure of hydrogen than any other catalyst.

Fluid Hydroforming

The new fluid Hydroforming process, result of extensive development work by Standard Oil Development Co., Standard Oil of Indiana, and M. W. Kellogg Co., improves the economics of the basic catalytic reforming process by utilizing the fluid catalyst principle. In these new units, the catalyst, instead of being held in reactors, is finely powdered, and moves continuously through the system supported on oil vapors and air. Shutdowns to regenerate catalyst are eliminated. What's more, the actual catalytic reaction is improved because the finely powdered catalyst provides better catalyst-oil contact than the pelletized variety used in fixed bed reactors.

Daily operating costs will be about 30 percent lower than those of a fixed-bed with the same capacity. Yields will be 3 to 5 percent higher, according to data from Kellogg's pilot plant. This is principally due to the uniform nature of the reaction, a result of the uniform temperature throughout the fluid bed.

Houdriforming

Houdriforming, developed by Houdry Process Corp., is another continuous process for catalytically reforming low-octane petroleum naphthas to aromatic concentrates and high-octane gasolines. Plans for commercial-scale operation are well-advanced.

Dual-function catalysts have been developed for this process. These catalysts are very selective for (1) the dehydrogenation of C_6 ring naphthenes, (2) the dehydro-isomerization of alkyl cyclopentanes, and (3) the isomerization of normal and slightly-branched paraffins into highly-branched paraffiins. Essentially no hydrocracking occurs, and, therefore, substantially pure hydrogen (97+ percent) is produced. The catalysts are not affected by sulphur compounds including thiophene. The process is nonregenerative, although for flexibility of operation and for protection in case of error in operation the catalyst can be regenerated in place.

Atlantic Refining Co.'s new reforming process features an improved supported platinum catalyst. Besides improving gasoline quality, practically all the naphthenic hydrocarbons in the feed are converted to aromatic hydrocarbons, and normal paraffins are converted to the higher anti-knock iso-paraffins at the same time. Conversion of the naphthenes to aromatics is effected by a dehydrogenation reaction somewhat parallel to the operations carried in Hydroforming and Platforming. Dehydrogenation provides an offgas containing 97-98 percent hydrogen together with small quantities of the lower hydrocarbons.

Platforming

The Platforming process, developed by the Universal Oil Products Co., involves the continuous reforming of straightrun and cracked gasolines in the presence of a supported platinum catalyst and utilizes a hydrogen recycle. One of the major reactions in Platforming is the formation of aromatic hydrocarbons. A plant which operates for the production of motor fuel can operate equally well for aromatic production. Some plants are being designed to operate intermittently for the production of aromatics and motor fuel. Others are being designed for aromatic production and still others for motor fuel production.

OTHER APPLICATIONS

Carbon Bisulphide—The new high temperature process developed by Pure Oil involving reaction of sulphur vapor and methane uses a silica gel catalyst.

Daniel's process

Nitrogen Oxides—In the Daniels process for the direct oxidation of atmospheric nitrogen, now ready for commercial application, 2 percent nitric oxide is adsorbed and catalytically oxidized on silica gel. Nitrogen tetroxide may be converted to nitric acid, or sold as such.

Oxo Products—Examples of products made by the newly-developed catalytic Oxo synthesis (besides the alcohols mentioned above under synthetic detergents) are iso-octyl alcohol for plasticizers and isobutyraldehyde (intermediate for calcium pantothenate, one of the B vitamins).

Acetylene Derivatives—An example of the high pressure catalytic acetylene reactions based on the German technology and recently applied in this country is vinylation. In the vinylation of alcohols, potassium alcoholate is the catalyst.

Cimmac reactor

Hydrogenation and Polymerization—Metallic catalysts for hydrogenation and polymerization reactions have been put to work in the new Cimmac reactor. The reaction takes place at the surface of a metal being milled, where cutting action activates the metal forming a reactive hot spot.

Acrolein—New process for acrolein is the catalytic oxidation of propylene—which is cheaper than the thermal cracking of diallyl ether.

DDT—The first major departure (by Naugatuck Chemicals Div. of Dominion Rubber Co.) from the original process discovered in 1884 uses a fluosulfonic acid catalyst instead of the conventional H_2SO_4. This, combined with discovery of proper mole ratios of reactants and proper operating conditions, has given a practical, continuous DDT synthesis.

Organic Wastes—A new vapor-phase catalytic process for oxidizing organic wastes to carbon dioxide and water was recently announced by Du Pont. Copper chromite is the catalyst. The process probably will prove to be more convenient than biological treatment and cheaper than non-catalytic oxidation at high temperatures.

K. S. ADAMS: ". . . 556 chemical engineers."

KARL T. COMPTON: *"I am no tax expert, but . . ."*

Phillips' Achievement . . .

An audience of almost a thousand gathered at a banquet in the Waldorf-Astoria Hotel in New York on November 28 to present the 1951 Award for Chemical Engineering Achievement to the Phillips Petroleum Co.* Sponsored since 1933 by McGraw-Hill on behalf of the chemical engineering profession.

These awards are unique in that they recognize group effort rather than individual achievement. The company to be so honored is selected by secret ballot of the heads of the departments of chemical engineering in all courses accredited by the Engineers Council for Professional Development and the American Institute of Chemical Engineers. Toastmaster on this occasion was Sidney D. Kirkpatrick, editorial director of *Chemical Engineering* and *Chemical Week*, and vice-president of McGraw-Hill Book Co. who also serves as secretary of the Committee of Award.

PRESENTATION

Alfred H. White

It is an honor as well as a pleasure to have served again as chairman of this committee of 70 senior professors of chemical engineering in the various colleges of the United States. We have carefully studied recent progress in the application of chemical engineering to the process industries. Advances have been rapid and notable achievements recorded in many fields which were presented to our committee for consideration this year.

It is noteworthy and cheering that the 1951 Award should go to a representative of an industry which has in a generation changed its mode of operation from rule-of-thumb distillation of various kinds of fuel oil from crude petroleum, to one which has assembled great scientific and technical staffs and which synthesizes large quantities of new chemicals to be converted into new products of great benefit to the whole human race.

In our considered opinion, the Phillips Petroleum Co., through its pioneering production of high-abrasion carbon black and its contributions to the development of cold rubber, has made the most notable achievement of our profession during the past two years. In the name of our committee, I present through you, Mr. Adams, to the Phillips Petroleum Co. and its subsidiaries this eleventh Award for Chemical Engineering Achievement.

ACCEPTANCE

K. S. Adams

It is with sincere appreciation and a deep sense of humility that I accept this 1951 Chemical Engineering Achievement Award in behalf of Phillips Petroleum Co. and its chemical engineers. Development of high abrasion carbon black and major contributions to the success of cold synthetic rubber have won this coveted award for Phillips. Together they have tipped the balance from natural to synthetic rubber for tire treads, thus making the United States more nearly self-sufficient in rubber, contributing to the nation's defense, and insuring low-cost transportation for our millions of motorists.

You will understand and pardon, I trust, the great pride I have in the many fine people in our organization whose genius and persistent efforts have brought this award to our company. Only history will be able to evaluate the full extent of the contributions of their work.

I sincerely regret that the many persons whose efforts have culminated in this award cannot be individually recognized to receive their due credit. However, were this done, virtually all of our technical staff and many other employees would have to be named for this honor.

While recognizing and honoring individual achievement is meritorious, we should not overlook the fact that most industrial projects call for group activity. Likewise, close coordination between top management and technical staff is essential if developments in the vital field of chemical engineering are to pay real dividends in public benefits as well as in company profits.

A recent count showed that among the 2,200 graduate technical and scientific employees of our company, there are 556 chemical engineers. Of

* The program was broadcast over 226 stations of the Mutual Network and beamed by Voice of America around the world.

these 157 are in our Research and Development Department.

Sometimes we are asked how and why we use chemical engineers in research. In reply we point out that research chemists and chemical engineers work side by side to the extent that it is difficult to distinguish between the two on the basis of their assignments. Each has become familiar with the language and techniques of the other, approaching the problem, however, from different angles. Together we believe they make the most powerful research and development team that can be devised.

Throughout Phillips Petroleum Co. and its several subsidiaries, such as the Phillips Chemical Co. employees with little or no formal training in chemical engineering have adjusted themselves to those habits that permit the results of chemical engineering to be used most rapidly and effectively.

Since our research and chemical engineering work over the years in high abrasion carbon black and cold synthetic rubber has involved many who are not classified as chemical engineers, this award is, therefore, a tribute to chemical engineering in its very broadest definition, namely, the art of organizing and directing the forces and materials of nature for the benefit of mankind.

Acceptance of this award carries with it a constant challenge to all of us in the widely diversified Phillips organization. We have an abiding faith in the aptitude of our scientists and in the ingenuity of the individual. Moreover, we are confident that our achievements, past and present, will serve as a firm foundation for undreamed-of developments and discoveries.

You have our pledge that Phillips will endeavor to contribute more than ever toward the nation's welfare in the critical days ahead.

Through happy coincidence, it is significant and appropriate that this award should come to Phillips on the 78th anniversary of the birth of the company's founder, the late Mr. Frank Phillips. It was largely through his foresight that our company became one of the early pioneers in petroleum and chemical research.

In closing, I wish to express our company's gratitude to the 70-member Committee of Award for the consideration given our accomplishments; to *Chemical Engineering* and the McGraw-Hill Publishing Co., sponsors of the Award, to Professor Emeritus White for his generous presentation remarks, and to Dr. Compton for his willingness to address us on this occasion.

PHILLIPS' ACHIEVEMENT . . .

. . . Spotlights A Threat

Karl T. Compton

"There are insidious dangers."

The spectacular developments of chemistry as a science, of chemical engineering as a profession, and of the chemical industry as a major source of the products on which rests our high standard of living, have all occurred during our lifetime. To all of us who are so convinced that, in such developments, lie the opportunities for material prosperity and national security in the future, this Award for Chemical Engineering Achievement is a source of sincere gratification and encouragement. To you, Mr. Adams, and to your associates of the Phillips Petroleum Co., I express for this great audience of your friends—and your friendly but strenuous competition—our congratulations on your past achievements and our confident expectation of your future triumphs.

Many of us can remember back to the days when our only appreciation of the petroleum industry was through our kerosene lamps. Since that time this industry has provided 95 percent of the fuel requirements for the tremendous increase in power used by the American people. Its aggregate annual budget for research exceeds that of any other individual group. This research has led not only to a several-fold increase in the fraction of gasoline obtained from crude oil, but also in a great improvement in the quality of this gasoline and in its availability at a phenomenally low cost to the public.

On top of this basic production of gasoline, the oil industry, through research, has outstripped any other in developing byproducts from its basic raw material, in this case, crude oil. Some of these products have been obtained by skillful methods of extraction from the raw material; many others have been created from this raw material by chemical rearrangement of molecules to yield new materials not originally present in the crude oil. Synthetic rubber, alcohol, ethylene glycol, plastics are all examples of such products. And in this class are the two products with which the Phillips Petroleum Co. is particularly honored today—high abrasion carbon black and cold rubber.

These two achievements come on top of very significant earlier contributions to the oil, chemical and synthetic rubber industries by the Phillips technical staff of nearly 2,000 of whom 1,500 are engineers and more than 550 of these are chemical engineers.

When we say to Mr. John Q. Public that "these developments of high abrasion carbon black and cold rubber give you automobile tires which will wear for 50 percent more mileage; they reduce the requirement to import natural rubber; they reduce the size of the rubber stockpile which our nation must purchase to be self-sufficient in a war emergency," then he realizes that these technical developments mean something very real to him, in service and in economy.

So Mr. Adams in congratulating the Phillips company on this award, I also express both the appreciation of engineers for its technical achievement and the thanks of Mr. Common Citizen for its contributions to his welfare.

And now may I say that technological achievement can only happen with the aid of men who have the requisite training and ability, provided with the necessary facilities for doing their work, and operating in an environment favorable to sustained creative effort. Facilities can be provided, at a cost, if there is the will to do so. Of trained engineers for research and production there is a desperate shortage, which will be with us for several years in spite of anything we can do, and whose handling will require very intelligent effort if it is not to prove the weakest link in our national defense armor. But I would discuss particularly the environment essential to sustained creative enterprise.

By environment I mean those factors like incentive, opportunity, reward, prestige, regulation, and tax policies which stimulate and encourage new technological developments, or discourage them. This involves matters of public policy which are of very great concern to every person in the country. Not only does the public benefit through the availability of the new products and services, but a vast majority have direct financial interest in the continued financial prosperity of American business enterprise.

The aggregate number of stockholders who have invested in our business enterprises is estimated to be 15,000,000. Many more are indirect investors. For example, there are some 83,000,000 holders of life insurance policies whose benefits reflect their companies' investment of their funds. Add to these the investments of fire and casualty insurance firms, of pension funds, of labor union funds, and you have an almost universal direct financial interest in the prosperity of our nation's business. Add to this, the fact that most of us get our paychecks only to the extent that financial prosperity provides the money. So we are all concerned, or should be, to secure the environment which promotes sound and long-term business prosperity.

Our national prosperity has been based on the environment which we often describe, in an inclusive way, as the American System of Free Enterprise. When we compare its success to such competing systems as socialism or the authoritarian state, we have practical proof of its value. We ascribe its success to the scope which it gives to the ambition and enterprise of free individuals. The way, in theory at least, is open for any person, however humble his beginnings, to achieve the highest success of which his abilities are capable—whether it be to become a president of the United States, a captain of industry, a chemical engineer, a college professor, or whatnot. Ability, ambition, an element of luck—all subject to competitive factors—are the bases of careers, as distinguished from traditions or regulations. This is the ideal. We should be alert to preserve it.

Obviously, in such a complex society as ours, some regultions and safeguards are necessary in the over-all interest. The public must be protected against exploitation by selfish groups. Conflicts of interest affecting the public must be settled as equitably as possible by law if they cannot be settled by negotiation. All must share equitably in supporting the public services of government and national defense. These things are obvious and universally accepted.

But there are insidious dangers lest these necessary functions of government be extended in directions which are not in the public interest and which threaten our free enterprise system. Let me mention only three which seem to me to be very serious.

There are dangers in government subsidy, granted that subsidies may be well justified in temporary emergencies to relieve distress or to stimulate some special development. There is, of course, the susceptibility to political abuse and to raids by pressure groups. But another hazard was brought home to me by comments of several men prominent in British governmental, industrial and scientific circles.

These men deplored the British practice of direct or indirect subsidies to British industry for the purpose of strengthening its competitive position in world trade. Temporarily it helped, but over the long run these men were unanimous in saying that their governmental subsidies have served to perpetuate technological obsolescence.

The present tax structure, however necessary high taxes may be to approach the desirable "pay-as-you-go" policy, does not in my judgment provide an adequately healthy environment for promotion of new technological developments. To be sure there are some provisions favorable to small "growth" enterprises, and large diversified companies can plow back part of their earnings into research as legitimate business expense, instead of paying out up to 82 percent of these earnings in taxes. But the high excess profit taxes do undoubtedly serve as a deterrent to exactly the type of industrial growth which is just what is most desirable,—that aimed at new products, added employment and new sources of profits (and of taxes). I am no tax expert, but I cannot but wonder about the wisdom of placing a special tax burden on initiative and success.

Finally, I come to what seems to me to be the most glaring example of all, in respect to policies which discourage the type of free enterprise which is so essential to our future prosperity and strength. I refer to some of the recent activities of the Anti-Trust Division of the Attorney-General's Office.

As I understand it, the Sherman Anti-Trust Law was intended to protect free enterprise and to protect the public against gouging by combinations in restraint of trade. It certainly was never intended as a barrier to size or to success if these operated in the public benefit. But consider some of the things which have happened in the last twenty years or so.

Suits have been brought against companies for doing what they were asked or required by other governmental departments to do. Some of these suits have been settled by pleas of "nolo contendere" and payment of fines by the companies as an alternative to the trouble and cost of contesting the suits in the courts. It is felt by many that this is a species of blackmail by which the Anti-Trust Division is able to claim that it is the only government department, other than the Internal Revenue Department, which makes a profit.

Suits have been brought to break up an integrated industrial program of production and distribution, even though this integration is efficient, results in better service at lower net cost to the public, and operates amidst intense competition.

Suits have been brought where the only real basis is size and efficiency, even though it is admitted that there is no monopoly, that keen competition exists, and that the company concerned has brought to the public better service at lower cost.

Suits have been brought to deprive a company of the rewards presumably intended by our patent laws, even though the company spent millions on the new development, has actively developed an eager public market, has encouraged other manufacturers, has met stiff competition, and has made the product available to the public at a very acceptable cost.

In many of our most progressive industries, a large portion of the time of top management, which should be devoted to furthering the business, has had to be diverted to defense against attacks like these.

I am no expert in law or business or government. I am like most citizens, having a little stake in insurance and pension funds, a microscopic investment in industrial stocks, a job which depends in large part on our national prosperity, and an intense devotion to the organization which I serve and to our country. My life has been devoted to advancement of science and its useful applications. I worry about some of these inroads on the environment within which our free enterprise system has fluorished and has brought to all of us unprecedented opportunities and standards of living. We should do something to curb these threats. The first thing to do is to have them brought out into the open.

This is the reason I have taken, wholly on my own initiative, this opportunity to discuss some of the conditions which promote or hamper the technological achievements which are so basic to our national welfare.

Editorial Viewpoints

Inflation's 1952 Model

Twenty-six leading chemical companies showed profits *before* taxes of $1,034 million for the first nine months of 1951 as compared with $708 million during the same period in 1950. But it's news to nobody that the retroactive features of the new tax law put a terrible crimp in net earnings. They fell from $418 million to $360 million. So far this year our industry has paid out almost twice as much in taxes as it made in net profits. And, for the first time since Korea, it is beginning to feel the pressure of a new and different type of inflation.

Till now most chemical companies have been able to keep a bit ahead of the rising costs. Prices have gone up at about the same rate as wages. Volume increased to meet unprecedented demands. And despite moderate increases in transportation and raw material costs, business has recorded handsome gains in net profits.

Lately, however, more and more companies are being squeezed by what our economist friends have called the "cost-push" inflation. There is increasing resistance to further price rises as inventories are building up in customers' plants. At the same time costs continue to push upward with every prospect of further increases as the steel workers fight for an all-industry pattern of still higher wage scales. No wonder many companies are hard pressed for cash to pay the tax collector and at the same time go forward with their expansion and modernization programs. Yet we all know that higher productivity through more efficient plants and processes is the only way we have to absorb these higher costs and still stay in business. If we don't, where will the tax collector take his toll?

How Much for Market Research?

Few functions in chemical industry have developed as rapidly as market research. Twenty years ago it was a luxury indulged in by only the larger companies. Today it is not unusual to find many firms regularly spending between a half and one percent of sales for studies of new markets and marketing methods.

One of the reasons for its rise in favor is that chemical market research has become a much more accurate and exacting science. Current standards are high and are becoming increasingly severe as the industry is building up its record of successful performance. More market research data are available than ever before. More evidence has been accumulated to prove, if necessary, the dollars and cents value of this sort of research. And, more experienced organizations are now available to supply their services as consultants or to help in establishing new market research departments.

What Price Natural Gas?

Industrial users of natural gas might as well begin worrying about increased fuel costs and the question of adequate supply a few years hence. Producers, pipeline companies, and industrial customers can find plenty of straws to show the direction of the wind. In fact a veritable tornado of penalty for bad planning is likely to hit us with devastating violence when least expected.

Two serious errors of national significance have been made. First we have over-promoted natural gas to the point of burdening the reserves beyond reason. By this excessive development we have both increased costs in the field and forced excessive cost for transmission. Second, perhaps the more basic error has been in the planning for public-utility use of natural gas without admixture of manufactured gas in great areas a thousand or more miles from the source of this wonderful natural fuel.

Right now there are pending before the Federal Power Commission applications by pipeline companies to increase gas rates by more than $100 million per year. And that is at the wholesale level, obviously promising much greater increase to industrial and household customers. Unfortunately the household customers cause most of the trouble, but for political reasons pay less of the penalty.

If we were distributing at urban centers remote from the gas wells a proper mixture of natural and manufactured gas, the capital charges on transmission systems would be very much less because the capacity load factor would be substantially higher without a penalty to anyone.

The whole matter is very complicated. Few, if any, industrial users can fight back effectively to stop the upsurge in plans. It seems likely that we shall have too little influence also to compel use of mixed gas of about 800 to 900 Btu. per cu. ft. But we can begin right now to figure out how we shall get wanted fuel supplies in gaseous form when the approaching storm of short supply and excessive cost hits us.

Unfortunately we must do this worrying and planning even though local utility companies may be willing to contract with us for supplies at what seems like a reasonable price and with full assurance of continuous delivery. But those local utilities cannot make inadequate pipelines function adequately or prevent intervention by politically minded state and federal agencies in the interest of the small house-heating

customers who are the ones who are upsettting the economy program so badly for everyone. It takes a long time to arrange a new gaseous fuel supply of a proper sort at reasonable cost. Gas-burning industries better start that planning now.

Realistic Protection for Consumers

Chemical executives who have followed the problems of spray residues, chemicals in food, and related questions in the fields of drugs and cosmetics can take a great deal of comfort from the realistic interpretations of Commissioner Charles W. Crawford, Food and Drugs Administrator. Speaking recently before the American Bar Association, he very clearly spotlighted his official views of legislative needs to fill the present "Gaps in Consumer Protection."

Commissioner Crawford criticized and asked for legislation to prevent the "use of inadequately tested substances in food." No one can reasonably object to that, nor to his spotlighting as his item No. 2, "the need for similar legislation on cosmetics." There may be some difference of opinion as to how to determine when a commodity is "inadequately tested" and there may be similar difficulty in determining where to draw the line regarding "potent drugs that should be confined to prescription use." But none of these three legislative desires can be questioned as to purpose. All of them are definitely in the public interest. Chemical enterprise will support the commissioner in principle on all of them.

It is gratifying to know also that Mr. Crawford feels that foods, drugs and cosmetics should all be under a single government agency so far as regulatory control is concerned. A contrary recommendation of some years back by the Hoover Commission was, in our opinion, one of the few serious mistakes in the findings of that constructive group.

We congratulate Mr. Crawford on the clarity and persuasiveness with which he has set forth the need for removing a loophole in the present law which allows many "imitation" foods to be marketed in a way that amounts almost to an economic cheat of the unsuspecting buyer. We hope that Mr. Crawford's ideas on this point may be worked into a constructive improvement, without too drastic a variation of standards of identity when such a variation has sound reason back of it.

Two other statements of policy presented in the address also have our enthusiastic support and compliment. We sincerely hope that standards-making procedures may be modified soon, in line with the plan which he set forth for comment. Much, if not most, of the criticism of unduly legalistic procedure would promptly disappear, and much money would be saved for manufacturing enterprise, without introducing any risk to the public.

Most of all we thank Mr. Crawford for the spirit in which his review has been presented. There is need for some step-by-step refinement of the food law. If steps are taken in the constructive way which is now presented to us by the new commissioner, we know that all parties interested will benefit. We know too that both the public and the industry will profit from Mr. Crawford's plan to set up "better lines of communication between ourselves and the industries" and between the administration and the public. A more recent address in Chicago presented before the baking industry shows clear evidence that Commissioner Crawford knows how to set up these lines of communication and to make them function in a way that should restrain the demagogue as well as impress the industry with its proper responsibility.

"Give Blood—Save a Life"

They carried the pasty-faced kid into the surgery tent. The surgeon, halfway through a leg amputation, looked over his shoulder.

"Transfusion," he muttered through his surgical mask. It didn't take a second glance to tell that there couldn't be much blood—or life—in the form on the stretcher.

The medic gently lifted the blood-stained blankets. Another man, ready with a pair of scissors, methodically began to cut through jacket, shirt and undershirt.

"Get younger all the time, don't they?" one man said.

"Yeah, wonder if he'll ever get to shave that fuzz off again."

"Sure. Ain't you heard? Over 90 percent of these guys make the grade. It's the poor devils who never get to us that the Chaplain worries about."

The man with the scissors had now separated clothing and wound.

"Look at this guy's legs, Joe. I can't find a vein anyplace."

"Big veins in the neck," the surgeon replied. "We'll get this stuff into him if we have to use the jugular vein."

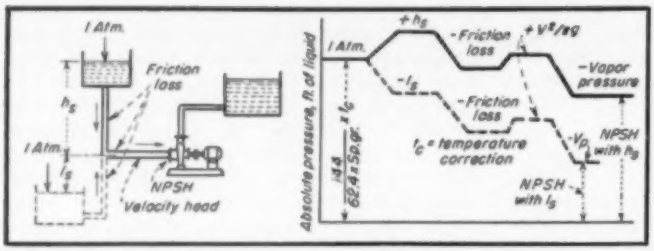
Deft fingers took over and the needle was in place in a twinkling. The precious red fluid began to flow, and with it the first real hope of life in five long hours.

"Hey lookit this. This blood's from Africa. Suppose this guy's a southerner?"

"Naw! Them southern guys moan with a drawl. This guy's moans sound like Brooklyn."

The three men laughed. For the first time in days. They were human after all. They had begun to wonder if there were any humans left in this crazy world.

Maybe there were then. Maybe there are now. And maybe there are some readers of *Chemical Engineering* who will recognize this as a true story of World War II. It was written by one who has good reason to know that your blood may save a life in Korea today.



In a pumping system such as that at the left, the various heads and losses add and subtract as shown at the right to produce Available NPSH.

What NPSH Means in Choice Of a Centrifugal Pump

Suction problems in centrifugal pumping are getting more attention. To understand NPSH helps to avoid trouble.

E. J. HANSON

When an engineer designing a plant decides on a pump, he must also decide where he is going to put it in relation to its suction tank. After he has placed it theoretically where the structural and mechanical features of the set-up indicate as best, he must then evaluate the suction conditions to make sure there will be enough "push" at the pump entrance. Otherwise, the pump will never have a chance to impart its energy to the liquid. It is good policy to play safe and put it right at the tank side, but even this may not always be enough.

The critical spot in pumping is the suction side. At the discharge we have a variety of pressure increments that we can work with. If the pump delivers 100 psi. at the discharge, fine. But at the inlet there is only 14.7 psi. at best that can be utilized as driving potential, without artificially creating higher than atmospheric pressure at the suction side. Since no pump can produce a perfect vacuum at the eye of the impeller, this figure is only a pipe dream, and two-thirds of this value is the accepted increment. When one considers friction loss and any suction lift that may be necessary, things start getting worse since these all lessen the potential. Add to this the vapor pressure of the liquid, which never fails to be of considerable importance in chemical process work, and you can see why pump companies started making claims of minimum required potentials for their own little "paddle wheel jobs."

After some hard thought the manufacturers came up with something they believed would help evaluate pump capacity, as determined by suction conditions. They called it Net Positive Suction Head (NPSH), a new name but really not a new idea. They divided it into two parts—Available Net Positive Suction Head and Required Net Positive Suction Head.

The first of these is the total head available at the inlet of the pump and is a characteristic of the suction system which supplies the pump. Take the pressure on the liquid surface in the suction vessel—usually atmospheric pressure. Subtract the friction loss in the suction pipe and subtract suction lift (or add suction head) for the difference in elevation between the suction level and the pump impeller eye. Add the velocity head at the inlet (often small enough to neglect) and subtract the vapor pressure of the liquid at the suction temperature. With all of these factors expressed as feet of the liquid, the result is Available NPSH.

This figure doesn't mean much by itself—until you match it with the required NPSH. The latter figure is dependent on the pump design and is the minimum driving head at the pump inlet, above the vapor pressure of the liquid, which the pump must have to operate "normally" at any given capacity.

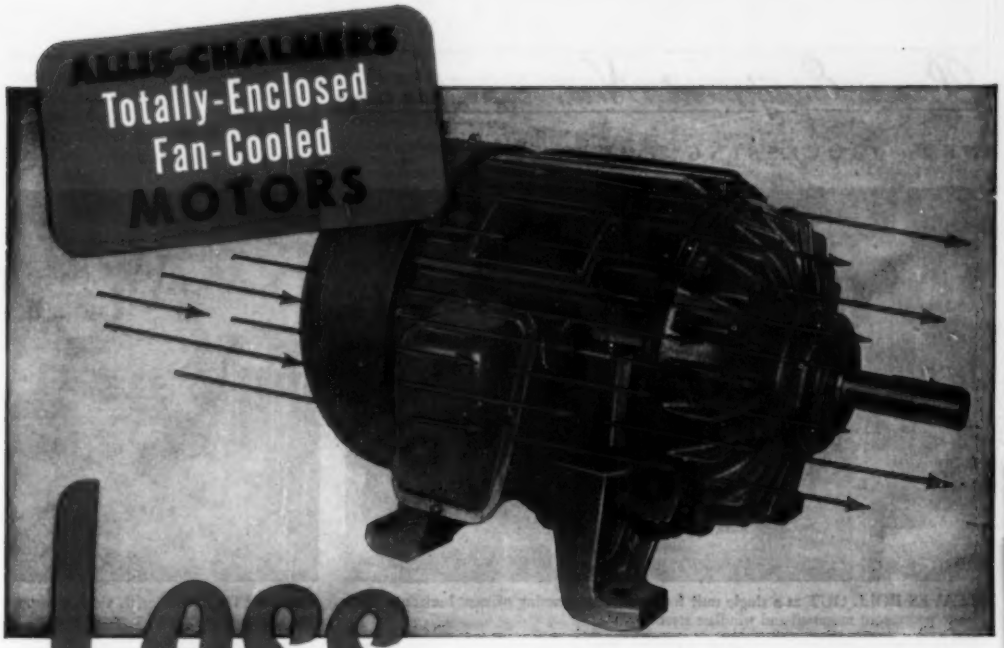
Evaluating the required NPSH involves such factors as impeller eye dimensions, suction area of impeller, area between vanes, impeller specific speed, shape of all suction passages and shape of vanes, etc. To use such dimensions without other considerations as correlating factors is useless since different designers use these quantities in different proportions to achieve the same result. That is, a designer using a given fluid under given suction conditions achieves a certain head and capacity by allowing the entrance vane angle to be a certain figure. The work of another designer may have an entirely different angle, but the capacity and the head characteristics will be approximately the same because of other compensating factors such as vane curvature design. Under other inlet conditions the performance will be different.

Hence, pump dimensions can never be considered solely in estimating the suction requirements of the pump. Furthermore, even though tests can be run using a single pump and single liquid throughout, and a certain Required NPSH correlation achieved by varying inlet pressures, temperatures, etc., it is not sound to go from water to latex or mercury on the strength of these data.

Some Required NPSH curves have been charted with boiling water as the liquid. Results can be used on boiling water applications if the same pumps are used as were employed in the tests. The trouble arises when you go from water to another fluid where viscosity, vapor pressure, density, Reynolds number and friction factors change the conditions. The problem is highly aggravated when you consider that the slightest vapor coming off at the eye of the impeller expands and slashes the liquid capacity.

What can be done about NPSH? It is clear that pump manufacturers must rely on experience, and that we can't accept extrapolation in pump performance when approaching critical conditions. To do so may be costly in both time and money. However, there is a good deal that can be done to assure pumping results. Some of this is under control of the process designer and affects the available NPSH. Some depends on the choice of the type of pump and controls the required NPSH, making sure that it will not be too great. To summarize Taylor's discussion (*Chem. Eng. Progress*, **46**, 637, Dec. 1950), we can (1) increase the Available NPSH by elevating or pressurizing the supply, lowering the pump, or by decreasing the friction loss with larger pipe; (2) use a pump with lower inlet losses or use two pumps in parallel; (3) use some form of booster pump; (4) subcool the liquid to reduce the vapor pressure; (5) remove undissolved gases by special pump design; or (6) use a special pump able to handle flashed vapors.

E. J. HANSON *is a chemical engineer of Mauston, Wis.*



Less MOTOR CLEANING ...INSPECTION...OVERHAUL!

HERE'S A MOTOR that actually blows itself clean! Dirt is carried away by cooling air blown over the ribbed cast iron frame and bearing housings of this new Allis-Chalmers tefc motor.

Dirt can't build up to cause overheating. Concealed air passages and pockets have been eliminated. Even oily dirt that sticks can simply be wiped or blown off.

And this means savings! Maintenance costs are traditionally low on totally-enclosed, fan-cooled motors. But they're lower than ever before on the new Allis-Chalmers Type APZ tefc motor.

Rigid Construction

The frame is cast iron which has high resistance against corrosion and distortion. Bearings are pre-lubricated at the factory and should need no attention for years. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are standard equipment.

Get All The Facts

The new Allis-Chalmers Type APZ totally-enclosed, fan-cooled motor is built in all NEMA standard frame sizes from 224* to 505. Also in explosion-proof type. Your A-C Authorized Distributor or District Office has complete information. Call today, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7225. A-3426

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CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

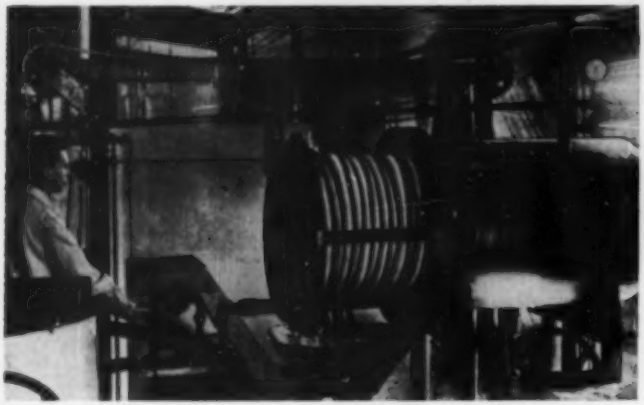
PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

*Similar design non-ventilated motors Type APK, also available in frames 203 to 224 inclusive.

NEW PROCESSING EQUIPMENT

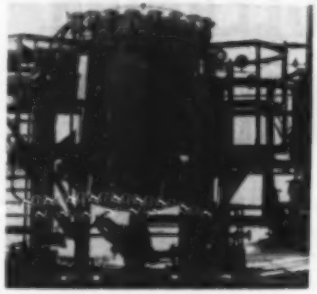


LEAVES ROLL OUT as a single unit for quick easy cleaning of new horizontal filter. Note permanent monorail and windlass assembly.

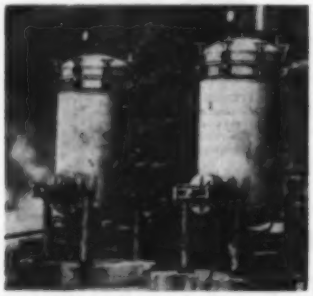
LABORATORY MODEL yields performance data for a variety of conditions.

Pressure Filters Maintain Fast Pace

Two new developments are the latest in a steady stream of improvements in Niagara filters.



REFINERY removes iron sulphide particles from spent solutizer solution.



JACKETED filters clarify molten sulphur in contact acid plant.

(176A) A new horizontal pressure-leaf filter, designed for jobs where large volumes of solids must be recovered or discharged, has just been introduced by Niagara Filter Corp. It cuts cleaning labor, entirely eliminates the use of cloth, and in comparable sizes can produce up to three times the output of conventional filter presses, it is claimed.

Another new development by this same manufacturer is a working model of the standard vertical filter. From this model you can get laboratory performance data which permit accurate scale-up to a proposed plant installation. It is made with either glass or stainless steel shell.

Niagara's first filter was sold for beer clarification in 1939. Since the original personnel were particularly well acquainted with the brewing industry, this was a logical entree. But the company was founded primarily to develop pressure-leaf filters for the chemical process industries. That this goal has been achieved is evidenced by two facts: Annual production of filters amounts to a dollar value running into seven figures; over half of gross sales are made to the chemical and pharmaceutical industries, to such companies as Merck, Squibb, Monsanto, Du Pont and National Aniline.

Many improvements have been made since manufacture began. The most important of these was development of the solderless, all-stainless steel, internally self-cleaning filter leaf. The drainage characteristics of this leaf and its sturdy, long-life construction have contributed to the wide acceptance of Niagara filters.

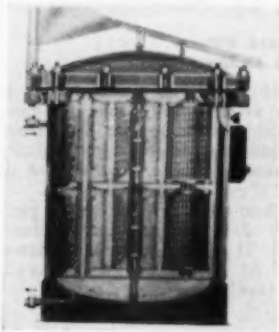
Another advance was the Auto-Sluice filter, which permits completely automatic cake removal and disposal. The company is working on, and soon expects to announce, an automatic sequence operation filter which will handle a wide range of operations, such as precoating, filtering, cake washing and air blowing.

The new Style H horizontal filter, as illustrated, consists of a horizontal tank containing a retractable carriage on which stainless steel leaves are vertically mounted. A hand-operated or motorized windlass and monorail assembly is a permanent integral part of the filter. You withdraw the carriage from the tank as a single unit. Cake is quickly separated from the leaves by rapping them with a rubber mallet. The cake drops into a suitable hopper,

trough or wheelbarrow. The entire cleaning operation for even a large unit is said to take no more than a few minutes.

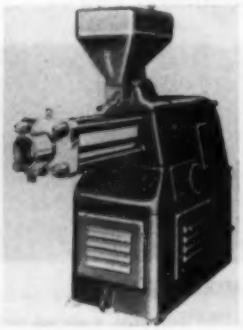
A further time-saving feature of the new filter is the simple quick-opening cover which locks and unlocks with one motion. The usual handwheels, eyebolts, etc., are eliminated.

Tank sizes up to 150 cu. ft. cake capacity are available, with flow rates up to 1,000 gpm. The tank may be steam-jacketed for high-temperature operations.—*Niagara Filter Corp.*



Oil Filters
Feature Quick Opening

(177A) An improved line of Hilco oil filters features swing-bolt head construction for quick opening of filter covers and a lifting device for ease of handling. Filters are available using both factory-made cartridges and the type which you repack yourself from a bulk supply of filtering material. Capacities range from ½ to as much as 1,000 gpm.—*Hilliard Corp.*



Extrusion Machine
Uses Multiple Screws

(177B) The Windsor plastics extrusion machine, developed in Britain, is now being introduced in the U. S. This machine uses a multiple screw which exercises a positive and constant pressure on the material fed to the barrel and forced through the die. There is a complete absence of pulsation. As a result, you get uniform thickness and close tolerances, even for products with adjacent sections of different width.

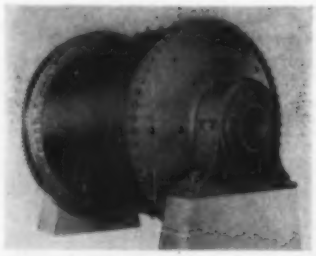
These extruders are available in three models—the RC-65 and the RC-100, twin-screw extruders, and the RC-200, a triple-screw machine. The model number indicates nominal capacity in lb. per hr.

Typical products made in these machines are tapes, sheets, tubing, channel and other sections.—*F. J. Stokes Machine Co.*

IN BRIEF—A capsulated listing of this month's newsworthy equipment.

		Page
Processing Equipment		
Pressure Filters	New horizontal model, laboratory model	176A
Oil Filters	With swing-bolt head and lifting device	177A
Extrusion Machine	Multiple screws exercise positive pressure	177B
Continuous Ball Mill	Improved for greater economy and reliability	178A
Liquid Filters	Now available up to 100 gpm. capacity	178B
Instruments and Controls		
Float-Operated Valve	Opens with only a small float drop	178C
Pneumatic Controller	Mounts directly on the valve motor case	178D
Differential Pressure Unit	Teflon and Monel resist corrosive gases	178E
Scanning System	Monitors up to 270 separate temperatures	178F
Viscosity Meter	Portable, operated from storage battery	180A
Viscosity Meter	New setup handles thixotropic materials	180B
Electronic Scale	Uses Baldwin SR-4 strain gages	180C
Automatic Recorder	Measures and records in digital form	180D
Telemetering Equipment	Response speed of less than 0.3 seconds	180E
Control Unit	One knob adjusts proportional and reset responses	180F
Potentiometer Circuit	For measurement of differential temperatures	180G
Pocket Thermometer	With one-piece case	180H
Beta Gages	Measure weight per unit area of sheet materials	180I
Servomechanism Unit	Demonstrates a typical servo system	180J
Electrical and Mechanical Equipment		
Compressor Drive	Gas turbine with two shafts	182A
Synchronous Motor	For control and instrument problems	182B
Atomic Battery	Radioactivity generates electric current	182C
Hydraulic Test Stand	Provides pressures to 30,000 psi	182D
Packaging and Handling Equipment		
Sludge Feeder	Handles sticky or plastic mterials	184A
Pallet Loader	Speeds materials handling operations	184B
Belt Splicing Method	Places all cables under equal tension	184C
Fork Truck Device	Attachment carries drums horizontally	184D
Belt Training Carrier	Keeps conveyor belts centered	184E
Safety Equipment		
Portable Foam Tower	Protects tanks up to 50 ft. high	186A
Vibrating Unit	Relieves aching feet, even with shoes on	186B
Respirator	Removes the finest dust particles	186C
Inhalator	Applies automatic artificial respiration	186D
Dust Hood	With clear acetate window	186E
Heating and Cooling Equipment		
Electric Heaters	Flat elements are readily bent and formed	188A
Spray Cooler	Delivers moist cold air	188B
Pipe Insulation	Made of asbestos fibers with inorganic binder	188C
Flare Burner	Disposes of large volumes of waste gases	188D
Heat Exchangers	Corrugated aluminum sheets assembled by brazing	188E
Heating Tape	Produces high wattages without red heat	188F
Fluids Handling Equipment		
Process Pump	Magnetic drive eliminates seals	190A
Pipe Hanger	Provides simplified field adjustment	190B
Triplex Pump	Discharge pressures up to 20,000 psi	192A
Rotary Pump	Suited for non-lubricating liquids	192B
Valve Seal	Closes in the same direction as the flow	193A
Reducer Fitting	Connects different sizes of tubing	193B
Neoprene Hose	Resists oils and abrasion	194A
Atomizing Nozzle	Mounts in line with connecting piping	194B
Packaged Compressor	Saves on foundation and installation costs	194C
Iron Valves	Offer steel valve features	194D

Don't Forget: Reader service postcard inside back cover will bring you more information. Use these key numbers



Continuous Ball Mill Has Been Improved

(178A) An improved heavy-duty continuous ball or tube mill incorporates features which are said to insure economy and reliability of operation. The mill can be used for fine or coarse grinding, wet or dry grinding, and open or closed circuit grinding.

Among the principal design features are mill heads of cast steel, slightly conical in shape to provide maximum rigidity and strength with minimum weight. The shell is of welded steel drilled for the installation of replaceable cast alloy iron or steel linings. Where desired the mill may be lined with buhrstone or Porox blocks.

Standard sizes range from 2 ft. dia. by 2 ft. long to 10 ft. dia. by 24 ft. long.—*Patterson Foundry & Machine.*

Equipment Cost Indexes

(Marshall and Stevens Indexes of Comparative Equipment Costs, 1926 = 100)

Industry	Sept. 1950	June 1951	Sept. 1951
Average of all.....	171.5	180.9	179.1
Process Industries			
Cement mfg.	163.4	173.1	171.5
Chemical	171.4	181.1	179.5
Clay products	158.4	168.1	166.5
Glass mfg.	161.5	171.2	169.6
Paint mfg.	164.7	174.4	172.8
Paper mfg.	165.0	174.7	173.1
Petroleum ind.	167.8	177.5	175.9
Rubber ind.	170.2	179.9	178.3
Process ind. avg....	168.9	178.6	176.9
Related Industries			
Elec. power equip..	172.0	182.7	181.1
Mining, milling	172.1	181.8	180.2
Refrigerating	190.8	200.5	198.6
Steam power	160.1	170.3	168.7

Compiled quarterly for March, June, September, and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see E. W. Stevens, **Chemical Engineering**, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see **Chemical Engineering**, Feb. 1951, p. 188.

Liquid Filters For Large Capacities

(178B) The Synclinal filter is now available in 75 and 100-gpm. models, extending the size range beyond the 50-gpm. top capacity previously available. Mesh sizes of 30 to 200 can be had in all models.

These filters have no moving parts and offer a large capacity-volume ratio. The 100-gpm. model measures only 6½ in. dia. by 14 in. over-all. —*Marvel Engineering Co.*

NEW INSTRUMENTS & CONTROLS

Float-Operated Valve Controls Liquid Level

(178C) A new float-operated valve provides a simple answer for many liquid level control jobs. Except for the neoprene valve seat, all parts are made of copper or brass. The valve opens to full capacity with only a small float drop and closes tightly against supply pressures up to 100 psi.—*McDonnell & Miller, Inc.*

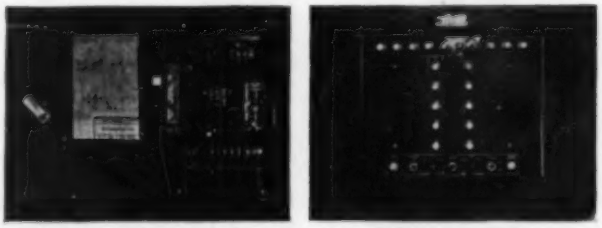
Pneumatic Controller Mounts on Valve Motor Case

(178D) The new Model 59 V/M pneumatic force-balance controller mounts directly on the valve motor case, thus eliminating the lag commonly caused by transmission line resistance between controller and valve. Measuring only 2¾ by 3¼ by 5 in., this controller is ruggedly constructed and fully weather resistant. It is designed especially for flow control, employs fixed proportional band and reset values.—*Foxboro Co.*

Differential Pressure Unit For Corrosive Gases

(178E) The Cat. 120 indicating control unit is an electronic control system designed to measure the differential pressure between a volume of corrosive gas, such as HF, and a surrounding gas. It consists of a sensing element and an indicating control unit. The sensing element will note a signal according to the variation in differential pressure and will produce a visual indication on the control unit located as far as 250 ft. away. The unit operates on 115-v., 60-cycle power.

The sensing element is contructed of special materials, such as Teflon and Monel, to withstand the action of corrosive gases. It consists of an iron core whose linear movement, carried by the differential pressure between two diaphragms, affects the inductance of two coils which are connected in a wheatstone bridge circuit.—*Henry G. Dietz Co.*



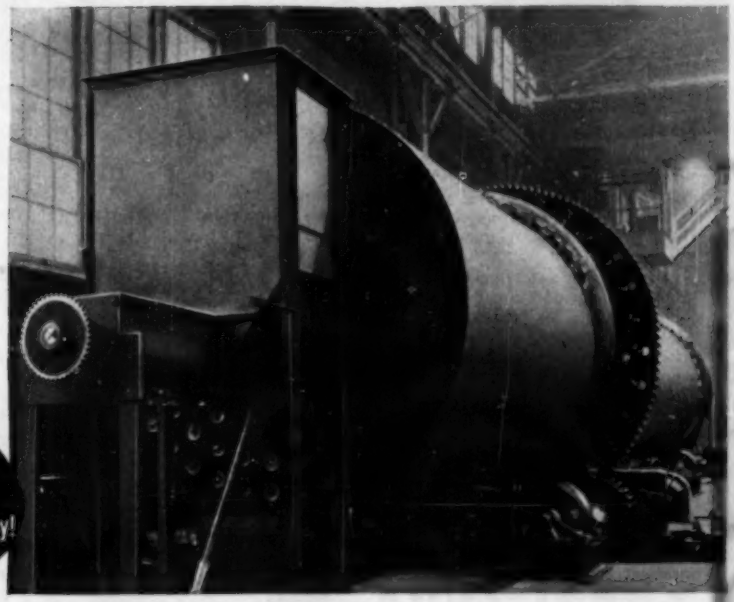
SCANNING SYSTEM MONITORS 270 TEMPERATURES

(178F) **A single set of instruments—a rectifier unit (left), a control unit (right) and a strip chart recorder (not illustrated)—continuously and automatically monitors up to 270 separate temperatures. The system records only those points which deviate beyond a pre-set limit. It includes an audible alarm that permits immediate correction of off-limit temperatures.—Minneapolis-Honeywell Regulator Co.**

See Louisville for

CREATIVE DRYING ENGINEERING

LOUISVILLE ROTARY DRYERS utilize 85% of all available heat in steam!



KNOW THE RESULTS before you buy!

Extremely high thermal efficiency is just one of the basic engineering advantages of Louisville steam tube Dryers. Any danger of case hardening is eliminated. Because of a very low air flow, finely divided material lost from the dryer cylinder is relatively small even though dryer may be handling unusually dusty material. Arrangements are included in each Louisville Dryer for complete and continuous removal of condensed steam . . . a unique steam joint eliminates all thrust bearings.

Louisville Dryers are safe, automatic and economical. They require a minimum of labor, supervision and maintenance . . . and are carefully built for years of dependable service.

Write for new treatise on rotary dryers. Or call in a Louisville engineer. Have him look over your drying operation. Possibly a "predetermined", job-fitted Louisville Dryer can turn a losing operation into a profit maker.

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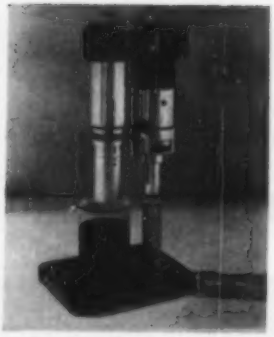


Viscosity Meter Is Battery Operated

(180A) The Fann V-G meter, a portable instrument for determination of viscosity and gel strength of fluids, weighs only 9 lb. and may be operated from a 6-v. storage battery. It is a rotational type instrument with five speeds.

Its measuring system employs a rotating outer cylinder and a stationary inner cylinder. The fluid being tested occupies the annulus. Torque on the inner cylinder is proportional to viscosity; this torque is balanced to a null point by suspended weights.—*Geophysical Machine Works.*

Viscosity Meter For Thixotropic Materials

(180B) The new Helipath stand, when used with a viscometer fitted with a special spindle, now makes it possible to measure viscosities of thixotropic materials with a rotational viscometer. A spindle in the form of an inverted T is attached to the standard Synchro-Lectric viscometer, which is supported by the new stand.

As the spindle rotates, the stand lowers the instrument at a constant rate through the material being tested. As a result the spindle traces a helical path through the fluid.

Throughout the path the spindle constantly encounters new material and leaves behind that which its previous motion has agitated. Thus, the instrument is always working on previously undisturbed material.—*Brookfield Engineering Laboratories.*

Electronic Scale Based on Strain Gages

(180C) The Ametron electronic scale uses Baldwin SR-4 strain gages for rapid and accurate weighing with a wide range of capacities. Weight is measured by the load cell and transmitted to any convenient spot for recording. The levers, pivots and bearings of conventional scales are eliminated.—*Streeter-Amet Co.*

GLENWOOD SUBSTATION

LINE CURRENT AND GROUP TOTALS MULTIPLY BY 10 FOR AMPERES

	01	02	03	04	TOT	05	06	07	08	TOT
	13	25	38	29	105	28	37	17	28	110
	13	25	39	29	106	27	35	16	27	105
	12	24	37	27	100	27	35	16	27	105
	12	23	35	27	097	25	33	15	26	099
	11	21	33	25	090	24	32	14	24	094
	11	21	32	24	088	25	30	14	25	090
	10	20	31	23	084	23	29	14	23	089
	10	19	30	23	082	22	28	13	22	085
	10	19	30	22	081	22	28	13	22	085
	10	19	30	23	082	22	28	13	22	085
	10	19	30	23	082	22	28	13	22	085
	10	19	32	24	085	23	30	14	23	090
	11	21	32	24	088	23	30	14	23	090
	11	22	33	25	091	24	32	15	24	095
	12	23	35	27	097	26	34	15	26	101
	12	24	37	28	101	27	35	16	27	105

Automatic Recorder Makes Numerical Tabulations

(180D) The Metrotype is an automatic system of making measurements and recording them in digital form. If telemetering is required, each reading is transmitted singly and recorded in tabulated form. The record may include totals or other computations.

As many as 20 carbon copies can be obtained from a single printer. Approximately 20 columns of two or three digits can be arranged on a page.

Measurable quantities are voltage, current, power, temperature, pressure, flow, level and production count.—*Metrotype Corp.*

Telemetering Equipment Gives Fast Response

(180E) The new Freq-O-Tron equipment, consisting of a transmitter and a receiver, provides remote metering of any quantity that can be converted to millivolts. With a response speed of less than 0.3 sec., exclusive of end devices, this equipment will transmit via microwave, power line carrier or pilot wire medium. You can arrange to get totals of similar quantities. — *Westinghouse Electric Corp.*

Control Unit Has One-Knob Adjustment

(180F) The new Bi-Act controller features a simplified control circuit which pneumatically links proportional and automatic reset responses together. A single knob adjusts both responses so that processes can be brought to a stable condition with ease.

The Bi-Act is a junior edition of the now well known Tri-Act controller. It is used as a component of the Transet control system to transmit the measured variable to a remote location. It is particularly adaptable to flow, liquid level or pressure applications requiring fast reset rates and broad throttling bands, or applications where derivative action is not essential.—*Taylor Instruments Cos.*

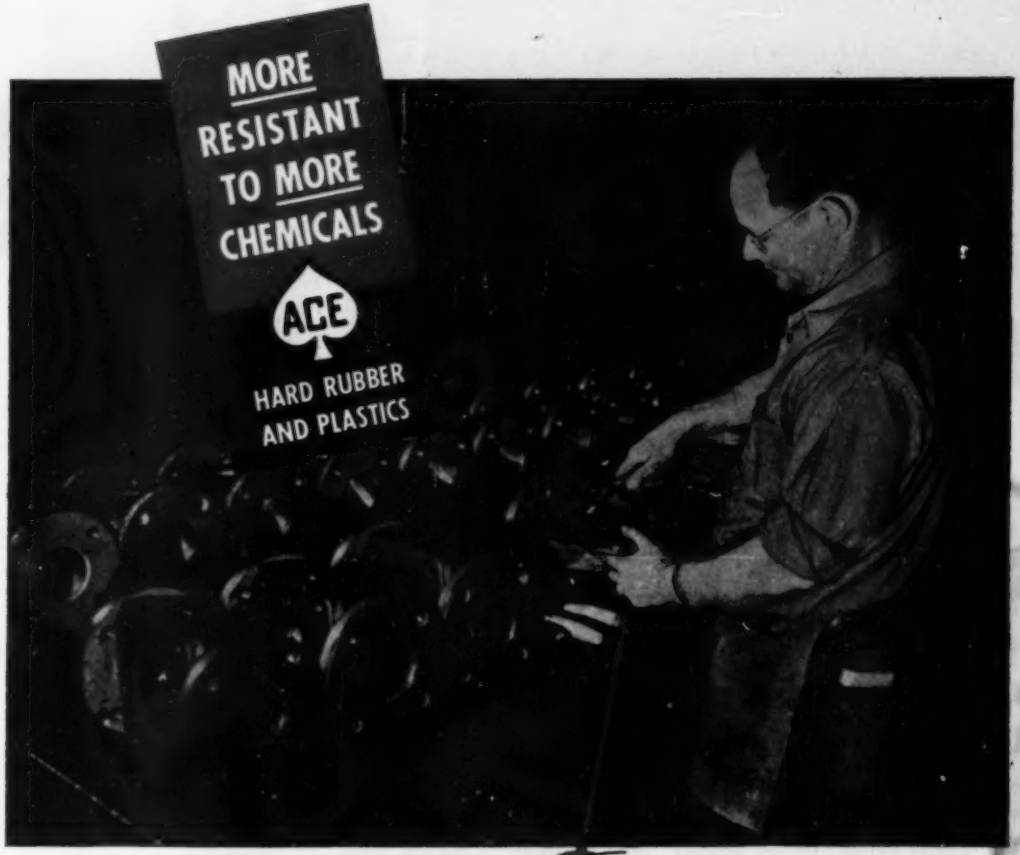
Instrumentation Briefs

Potentiometer Circuit—Measures spans as narrow as 100 microvolts. For precise measurement of differential temperatures and accurate determination of slight variations in temperatures. Minneapolis-Honeywell Regulator Co. *(180G)*

Pocket Thermometer—With one-piece case, visible expansion chamber. Weston Electrical Instrument Corp. *(180H)*

Beta Gages—Two new models for determination of weight per unit area of sheet materials. Gages are unaffected by speed of the moving web and do not contact the material being gaged. Tracerlab, Inc. *(180I)*

Servomechanism Demonstrator—Portable unit to demonstrate what a typical servo system is and does. Designed to show how either position or velocity can be controlled remotely. Servomechanisms, Inc. *(180J)*



HIS SKILL ADDS YEARS TO THE LIFE OF A VALVE...

IF WE HAD to decide the most important factor in the life and economy of rubber-protected corrosion-resistant equipment, we'd say it's the skill with which the hard rubber linings are applied. It takes the sureness, the deftness of experienced hands to produce a perfect, blister-free bond, with the neatest, most dependable seams.

Skill is a proud heritage at the plants of the 100-year-old American Hard Rubber Company. Many of our workmen have been on the job for a decade or more. Many represent second and third generations of skilled rubber workers.

We can supply you with rubber-protected tanks, pumps, piping, valves, fittings, and utensils for complete chemical processing, storage, or circulating systems. Saran and Parian (polyethylene) pipe and fittings also available. Just tell us what you're handling. We'll gladly make recommendations.

100th ANNIVERSARY

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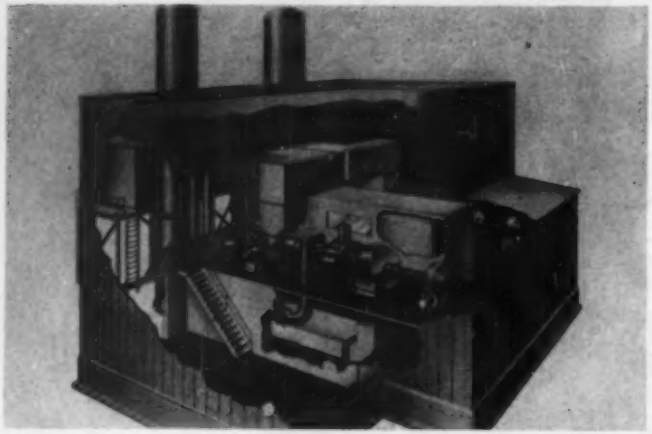


PUMPING station houses two 5,000-hp. gas turbine-driven centrifugal compressors.

Gas Turbine Compressor Drive

Pipeline pumping unit may lead to wider usage in process industry applications.

(182A) A gas turbine has been specially designed for driving centrifugal compressors in natural gas pipeline pumping service. It is rated at 5,000 hp. for 5,000 rpm., 80 deg. F. and 1,000 ft. altitude. Thermal efficiency is claimed to be 25 percent when operating with a regenerator to recover exhaust heat.

An essential feature of the new unit is its two-shaft design. The turbine is separated into a high-pressure section, driving the air compressor through one shaft, and a low-pressure section, driving the load, in this case the pipeline compressor, through another shaft. Turbine and compressor speeds can thus be varied to get optimum results.

Air is compressed in the 14-stage axial compressor to about 70 psig. It then passes through the regenerator, where it is preheated to about 800 deg. F. before going to the six cylindrical combustion chambers. Natural gas from the pipeline serves as the fuel, burning at a temperature of about 1,450 deg. F.

A fundamental characteristic of gas turbines is that they deliver more power as ambient temperatures decrease. Surplus power above rating is available most of the time, since the average temperature in most locations is below the standard 80 deg. F. In winter, when demand for natural gas is greatest, the gas turbine drive will deliver up to 25 percent more power at no extra investment cost.

Stations that house gas turbines are small in relation to available horsepower. The one in the above illustration, housing two 5,000-hp. units, is approximately 48 by 64 ft. Interconnecting ducts between the power units and the regenerators run under the operating floor.

Little or no cooling water is required. Lubricating oil is cooled by air-cooled exchangers. Some operating advantages can be obtained, however, by washing and pre-cooling the incoming air. Only 12 gpm. of water is required for this.

The present trend in pipeline units is toward larger sizes than the present 5,000 hp. Smaller units, of course, would cost more per horsepower. The manufacturer states, on the other hand, that units rated less than 5,000 hp. would be economical and competitive with other prime movers. The competitive position is dependent to a large extent upon the uses to which the exhaust heat can be put. Turbine installations where the exhaust heat is used for process heating are said to have over-all thermal efficiencies as high as 70 percent.—*General Electric Co.*

Synchronous Motor For Light Duty

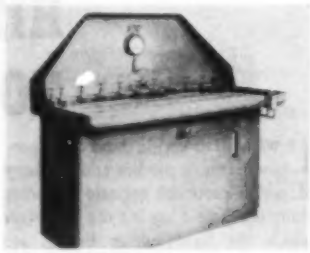
(182B) A new small synchronous motor is applicable to control and instrumentation problems. It operates on the reluctance principle, with no brushes, slip rings, rotating coils or permanent magnet. It can be built to operate continuously at any voltage below 250, either single phase or polyphase.

A typical motor is 4 in. dia. by 2⅛ in. long, weighs 2.6 lb. and develops 8 oz.-in. starting torque.—*Allis-Chalmers Mfg. Co.*

Atomic Battery Runs on Radioactivity

(182C) An atomic battery has been developed which generates an electrical current directly from radioactivity. Although this phenomenon has been successfully utilized to produce enough current to run a tiny motor, applications for the present are being limited to special types of instruments.

The first application is to a new line of instruments for the precise measurement of gamma activity. The new instruments require no high-voltage power supply, since the energy in the radioactivity itself produces the electrical current. Where some other types of instruments require 20 to 30 vacuum tubes, these require only one. —*Ohmart Corp.*



Hydraulic Test Stand Supplies High Pressures

(182D) Hydraulic test stands have been designed for testing flexible hose, valves, cylinders and other equipment. These stands include pumps, relief valves, oil reservoirs, motors and incidental valving and piping. They provide test pressures up to 5,000 psi., using large volume pumps, and up to 30,000 psi. with special booster equipment.—*Superdraulic Corp.*

SPEEDS ARE CHANGED in a few minutes, by removing the cover and changing the two easily accessible gears.

up to *16 SPEEDS* quickly interchangeable in this standard *LIGHTNIN MIXER*

When your fluid agitation requirements change, this *Series E* LIGHTNIN MIXER can change to meet them.

The new gearbox design gives you a choice of as many as 16 standard AGMA output speeds—from 16.5 to 420 RPM—all interchangeable in a few minutes' time, without special tools.

This and other LIGHTNIN features like *independent shaft suspension, interchangeable mountings,* and *standard interchangeable impellers,* give you real versatility to meet future needs. Lightnin Mixers *stay* useful in your plant —long after other mixers have become obsolete.

MIXCO engineers can show you how to cut processing time and boost output, with fluid agitation correctly adapted to your process. Their services include accurate prediction of the results you will get. Finally, every Lightnin Mixer is guaranteed to do the job for which it is recommended. For complete information, call in the MIXCO representative in your area, or write us today.

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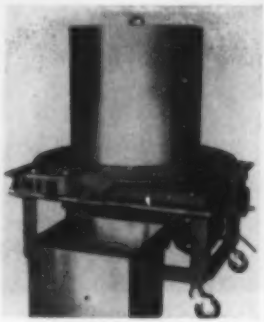


Sludge Feeder
Handles Sticky Materials

(184A) The new Com-Bin feeder will feed uniformly almost any sticky or plastic material, such as filter press cakes and other sludges of pigments, clay, damp salt, fertilizer, naphthalene containing oil, and many other products. On most materials the accuracy from minute to minute will not vary more than 2 percent as long as the cylinder is at least ¼ full, it is claimed.

The feeder consists of a cylindrical shell mounted concentrically on a rotating vertical shaft by means of spider arms. Below the cylinder, mounted on the same shaft, is a circular plate larger in diameter than the cylinder. There is a gap between the plate and the bottom of the cylinder; height of this gap is varied to suit the material being handled. A stationary plow extends through the gap.

As the cylinder and plate rotate, the plow continuously removes a stream of material from the bottom of the mass in the cylinder, discharging it off the edge of the plate. Discharge rate can be varied by varying the thickness of the plow, the distance the plow extends into the cylinder and the speed at which the entire feeder turns.

A trial installation has been in service for over a year on a salt containing enough moisture to make it very sticky. This material could not be handled with any type of more conventional feeder. This particular Com-Bin feeder has a cylinder 4½ ft. dia. by 4½ ft. high, holding a charge of 5,000 lb. A 1-hp. motor drives it at ¾ rpm. Sludge is discharged at a rate of 2,000 lb. per hr.

Com-Bin feeders will be available in a large range of sizes—from capacities of 5 lb. to 50 tons and feeding rates from a few pounds per hour to as high as 50 tons per hr. Normally made of carbon steel, they can be also furnished in corrosion-resistant alloys or plastics. Their design makes it easy to apply corrosion-resistant coatings to the carbon steel construction.—*Pulva Corp.*

Pallet Loader
Speeds Handling Operations

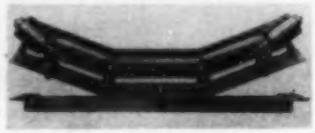
(184B) A newly designed automatic arrangement makes it possible to accumulate up to six loaded pallets while waiting for a fork truck to return from the stacking area. The truck otherwise might not return in time to remove the loaded pallets as they are ready, and automatic loading operations would be delayed. The new arrangement is particularly useful when alternate pallets are loaded with different commodities.—*Lamson Corp.*

Belt Splicing Method
Distributes Load Evenly

(184C) A new method of splicing steel cable conveyor belting places all cables under equal tension during vulcanization so that each cable carries its share of the load in the finished splice. It also permits the straightest possible splice, resulting in belts that run straight and true.

To make the splice, cable ends are cut in a staggered pattern. Small tubular connectors are placed over the butted ends. Connectors are first given a light crimping. The partially made splice is then stressed to even the lengths of the cables, and connectors are given a final crimping.

Rubber and fabric removed for the splice is then rebuilt around the cables. The splice is cured under tension with a conventional vulcanizer.—*B. F. Goodrich Co.*



Belt Training Carriers
Keep Belts on Center

(184E) A new automatic belt training carrier is designed to keep conveyor belts centered. Training rollers at either side respond instantaneously to any shift of the belt off dead center and swing the carrier into an angular position with respect to the direction of belt travel. This quickly returns the belt to center and the carrier resumes its normal position.

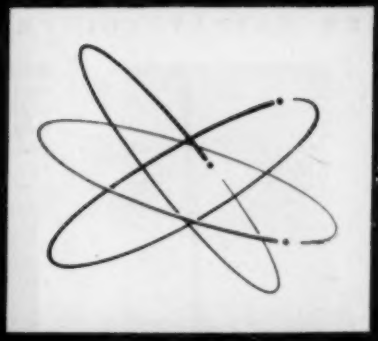
The centering action is said to be so effective that only a few of these carriers are needed. Spacings of 50 to 100 ft. are usually sufficient.—*Stephens-Adamson Mfg. Co.*

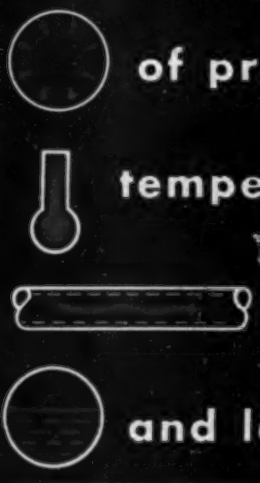
FORK TRUCK DEVICE CARRIES DRUMS HORIZONTALLY

(184D) **This new device can be attached to any industrial truck without removing the forks or making any hydraulic or mechanical connections. Completely automatic, it fits over the forks and is fixed to them with two screw clamps. Drums may be stacked to any height within the lifting range of the truck.—Yale & Towne Mfg. Co.**

instantaneous

all-electronic control





of pressure

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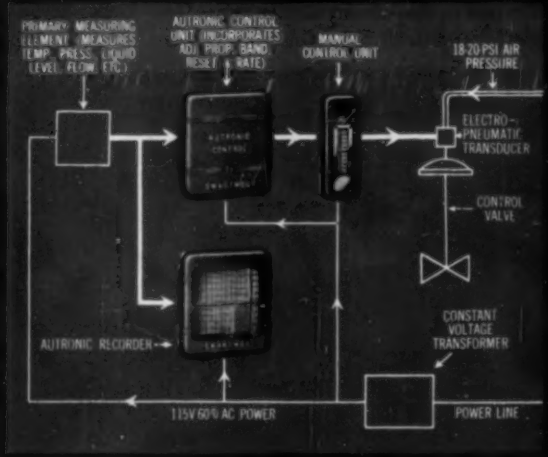
PRIMARY MEASURING ELEMENT (MEASURES TEMP, PRESS, LIQUID LEVEL, FLOW, ETC.)
AUTRONIC CONTROL UNIT (INCORPORATES ADJ. PROP. BAND, RESET & RATE)
MANUAL CONTROL UNIT
18-20 PSI AIR PRESSURE
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CONTROL VALVE
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The new Swartwout Autronic Control System brings new speed, new accuracy to your process controls. Without mechanical motion of any kind this new *all-electronic control system* spans distance between primary element and control element *without interval*. Measuring . . . analyzing . . . correcting —the Autronic System keeps your process on stream . . . assures quality product by controlling pressure, temperature, flow and level properly, instantaneously *without cycling, drifting, shifting*. Call in our engineering representative to explain how Swartwout Autronic Controls will bring new accuracy to *your* process and power instrumentation and control. Or write *today* for literature on the new Swartwout Autronic Control System.

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Portable Foam Tower Protects Large Tanks

(186A) A new portable device for discharging fire-smothering foam provides protection for large tanks up to 50 ft. in height. It may be quickly and easily assembled, erected and delivering foam in a few minutes. A built-in unit makes 2,000-3,000 gpm. of Pyrene air foam.

The equipment is assembled in two sections—a base with a screw-tilting gear mechanism and four spikes for use on rough ground, and a telescoped 20-ft., three-section tower with manual winch, two swivel-jointed push poles and stainless steel guy ropes. The tilting mechanism simplifies the application of foam. With the base in a stationary position, the discharge head can be moved forward 3 to 5 ft. over the tank edge to discharge foam against the inner side of the tank.

The tower is light and compact. Made principally of aluminum, it weighs only 475 lb. complete.—*Pyrene Mfg. Co.*

Vibrating Unit Relieves Aching Feet

(186B) Factory workers who are on their feet all day can now avoid fatigue and aching feet with a new device called the "Relaxo." It consists of a vibrating aluminum cylinder mounted on a low stand. The worker sits down by the machine, places his feet on the cylinder and moves them back and forth. Shoes need not be removed. The effect is one of stimulated circulation and relaxing of strained muscles.—*Oscillation Equipment Co.*

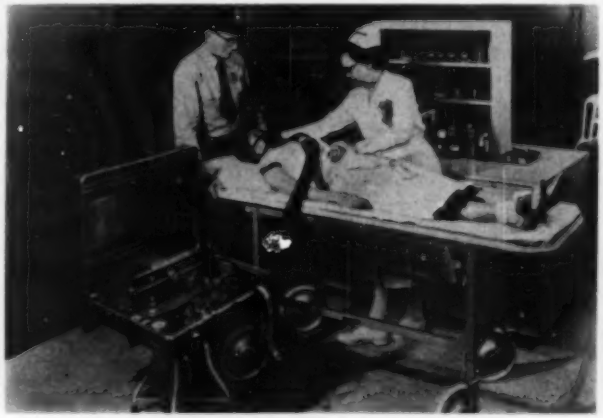
Ultra-Filter Respirator Protects Against Fine Dusts

(186C) A filter medium developed especially for removing radioactive dust from the air, just recently put into commercial production in the form of industrial air filters, is now being incorporated into individual respirators. Called the Comfo Ultra-Filter respirator, the new medium is said to have an efficiency of 99.99 percent against particles 0.3 micron in size.

The filter material contains a high percentage of special asbestos fibers and is assembled in several metal bound layers. This arrangement presents a very large surface area with correspondingly low resistance to breathing.—*Mine Safety Appliances Co.*

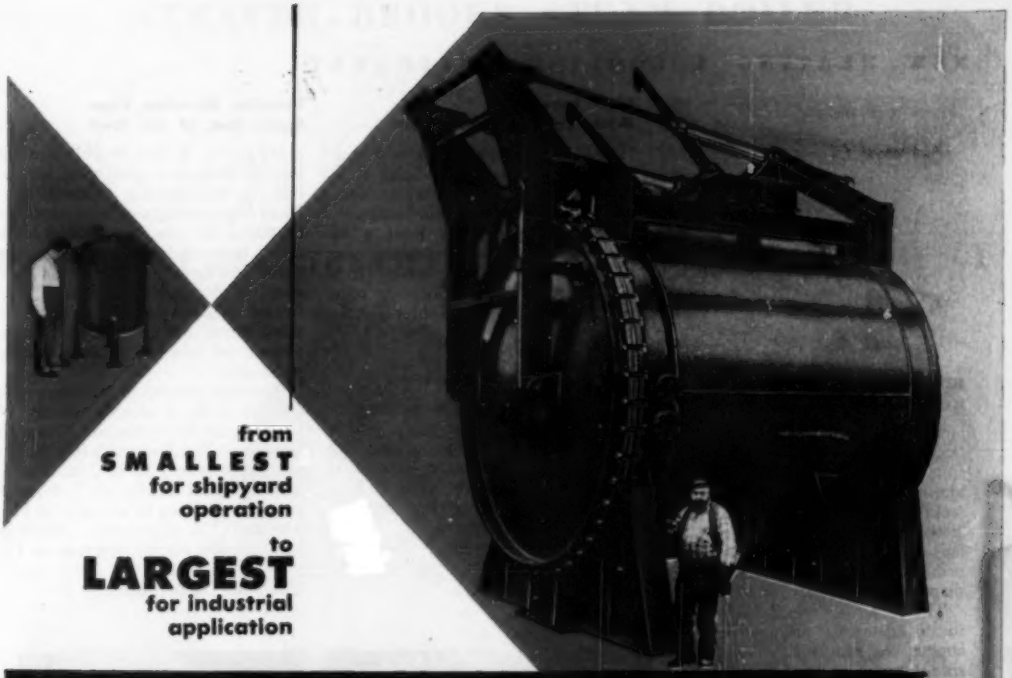
LIGHTWEIGHT DUST HOOD

(186E) **Resemblance to comic strip and television space suits notwithstanding, workers in atmospheres containing heavy concentrations of irritating dust will find this new dust hood quite useful. The 33-sq. in. window is made of clear acetate, the hood itself of lightweight cotton duck.—Willson Products.**



PLANT STAFF ADMINISTERS ARTIFICIAL RESPIRATION

(186D) **The hospital at Formica Co.'s new Cincinnati plant is equipped with an instrument for treating victims of any kind of respiratory failure. The Pneolator, the device shown in use, applies automatic artificial respiration without suction by means of an intermittent positive pressure valve, administers oxygen as an inhalator or serves as an aspirator to remove throat obstructions.—Mine Safety Appliances Co.**



from
SMALLEST
for shipyard
operation

to
LARGEST
for industrial
application

ACME IMPREGNATORS ARE MORE EFFICIENT!

The small impregnator illustrated above at the left measures only 36" in diameter. It is one of a battery of four especially designed and precision-built by Acme to meet specific conditions for a dock installation.

The large Horizontal Jacketed Impregnator, measuring 11'-4" in diameter and 17'-6" in length, has a volume of 11,000 gallons. It operates at 150 p.s.i. working pressure and full vacuum at a temperature of 650°F. An efficient hydraulic mechanism provides smooth operation of the 5-ton door.

Whether your processing problem is a midget or a giant in size—whether it encompasses engineering and design or fabrication alone—at Acme you will find the skill, the equipment and experience to insure the most economical solution.

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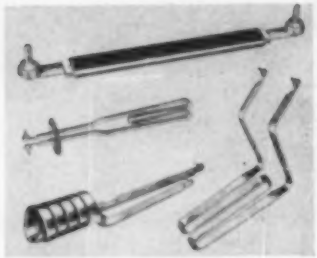


Electric Heating Element Readily Bent and Formed

(188A) A new flat sheathed electric heating element can be used for contact, convection, radiant or immersion heating. The thin flat cross-section makes it easy to obtain good contact, offers minimum flow resistance in convection, and facilitates bending and forming into any desired shape.

The elements are available in various sheath materials, although steel and copper are standard. They are resistant to moisture and, under ordinary conditions, do not require protection from atmospheric conditions. Inside the metal sheath is the round resistor wire, situated into a flat helix so that all of the wire surface is available for direct flow of heat toward the sheath. It is insulated from the sheath by uniform strips of a metallic oxide material of high thermal and electrical qualities.

A variety of terminals are available, or the heaters may be brazed or welded into various fittings or provided with holddown straps or brackets. Elements are furnished in heated lengths up to 10 ft. and in widths of 17/32 and 23/32 in.—*Syntron Co.*

Spray Cooler Maintains High Humidity

(188B) An improved No Frost spray cooler can be used for refrigeration and cold storage of products that require moist cold air. This cooler operates on the same principle as the one described in our May issue (p. 192), except that the air enters through the fans and is blown through the cooling units.

In the older model the air was drawn through the units first and then passed through the fans. The chilled air thus picked up heat from the energy of the fans which lowered its relative humidity. The new model avoids this condition.—*Niagara Blower Co.*

Pipe Insulation With Jackets and Bands

(188C) Amocel is a new pipe insulation for use up to 650 deg. F. It is made of Amosite asbestos fibers bonded with an inorganic binder.

Made in pipe sizes from ¼ in. through 12 in., it is furnished complete with jackets and bands. It is available in standard thickness only. —*Union Asbestos & Rubber Co.*

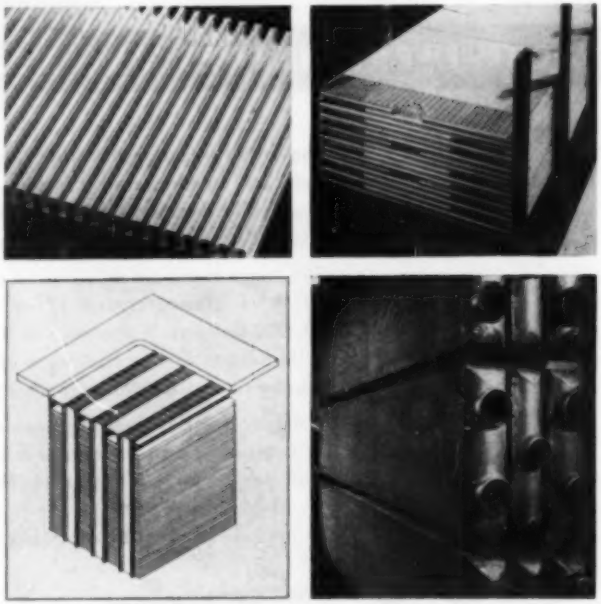
Field Flare Burner For Disposal of Gases

(188D) Smokeless burning of large volumes of waste gases, as well as low steam consumption and high resistance to heat damage, are claimed for a new field flare burner. It is made of heat-resisting alloys and uses a new method for cooling of the burner parts. Piloting is said to be completely stable in winds up to 80 mph.—*John Zink Co.*

Flexible Heating Tape Stays Out of the Red

(188F) A new flexible heating tape for wrapping small glass vessels, such as fractionating columns, produces high wattages without excessive heating of the wire. Operating at black rather than red heat, the new tape is claimed to be safe for use in the presence of flammable materials. This feature is made possible by a special construction which employs a large amount of wire in a comparatively small area.

The tape consists of resistance wire covered with a double sheath of braided glass fiber yarn, complete with lead wires. Standard width is ½ in., but any width from ¼ in. to 2 in. may be had. Standard lengths are 2, 4 and 6 ft., corresponding to wattages of 115, 190 and 275 respectively. Although you normally use the new tape on 110 v., you can get it for 220-v. use.—*Scientific Glass Apparatus Co.*



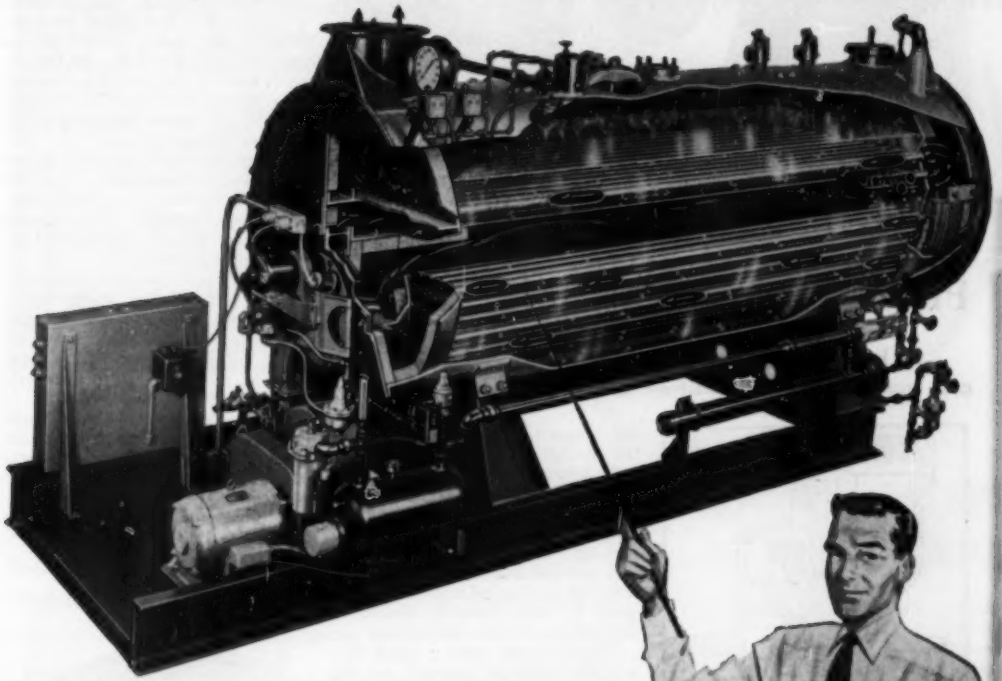
BRAZED ALUMINUM HEAT EXCHANGERS BUILT IN LAYERS

(188E) **Here's how the brazed aluminum heat exchangers announced in our September issue (p. 184) are made: Corrugated sheets (upper left) are stacked in layers between flat aluminum plates in a steel jig (upper right). The entire assembly is brazed together in a flux bath process to form a unit like that in the sectional view (lower left). Appropriate headers are welded on the ends (lower right). Serrated corrugations are used to vary the heat-transfer and pressure-drop characteristics of the exchangers.**—Trane Co.

CLEAVER-BROOKS STEAM BOILER

Four-Pass Construction

MEANS HIGH HEAT TRANSFER — GUARANTEED 80% EFFICIENCY



The basic reason for the high thermal efficiency and low fuel costs of Cleaver-Brooks Steam Boilers is graphically shown above.

Note the original and exclusive Cleaver-Brooks four pass construction of the boiler. The four complete passes of combustion gases traveling through the entire tube length of the boiler proper enables the boiler to absorb the greatest practicable amount of heat from the fuel burned.

All Cleaver-Brooks boilers are of the four pass design and the maximum useable heat is absorbed in these four passes before the combustion gases leave the boiler.

Cleaver-Brooks steam boilers offer many advantages . . . quick, effortless response to fluctuating steam demands — minimum manpower needed for operation and maintenance — clean — space saving — low cost installation — dependable performance — burns the fuel most available and most economical in your area — oil or gas.

Remember the name Cleaver-Brooks, it stands for the first and finest in steam boilers. Standard models available in sizes from 15 to 500 HP, 15 to 250 psi, oil, gas, combination oil and gas firing.

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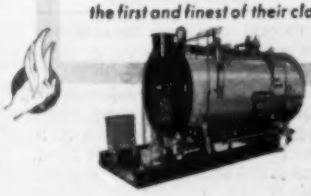
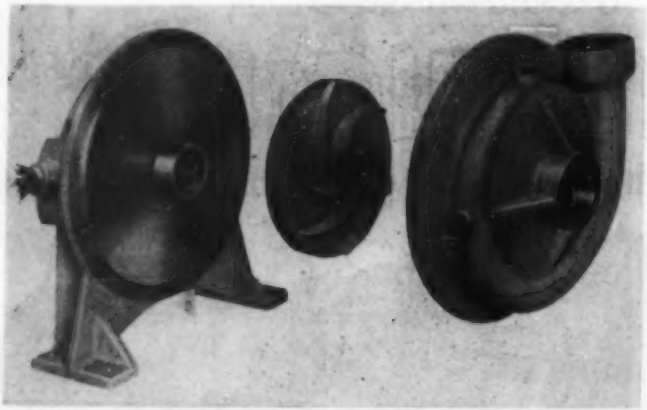
Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

Write for your copy of the latest illustrated Cleaver-Brooks Boiler Catalog. It tells and shows why Cleaver-Brooks Boilers will save you money.

Cleaver-Brooks
STEAM BOILERS
the first and finest of their class

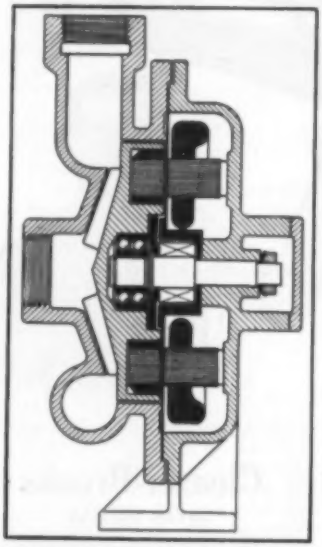




EXPLODED view shows the simple construction of the Hermetik pump. Magnetically driven impeller is completely sealed from the atmosphere.

Process Pump Has No Seals

Impeller is combined with the rotor of an axial gap motor. Drive is entirely magnetic.



SECTIONAL view shows the relation of stator and rotor magnets.

(190A) Chemical engineers can at last get a centrifugal pump which avoids all sealing or stuffing box problems. By combining motor and pump in one sealed unit, the Hermetik pump eliminates the need for any kind of seal between the pumped liquid and the atmosphere.

As pointed out in our September article on maintenance costs (p. 149), the chief cost in operating a centrifugal pump is maintenance of the pump packing. These costs often exceed each year the cost of the pump itself. Although mechanical seals have proved successful under favorable conditions, they still have many limitations.

The Hermetik pump is based on a radically different approach to the shaft sealing problem. Its only connections with the outside world are the suction and discharge pipes and the supply of electric power. There is no shaft extending through the casing.

The only moving part is the rotor-impeller. It is constructed with built-in magnetic elements of laminated silicon steel, just like the rotor of a motor, and is driven by the rotating magnetic field of the stator. The gap between the rotor and stator is sealed with non-magnetic stainless steel.

The first pumps built along these principles were based on the conventional radial air gap motor. Although they work fine for certain jobs, like in the new Westinghouse fluorocarbon-cooled transformer *(Chem. Eng.*, Oct. 1951, p. 193), they are extremely limited in capacity. The reason is obvious—the radial gap motor just doesn't allow you to use impellers with large enough diameters. As the motor increases in horsepower, it increases only slightly in diameter and greatly in length.

Along came the development of the axial gap motor, or pancake motor, by one of the nation's leading manufacturers, to provide the answer to this problem. As the horsepower of this type motor increases, the diameters of both rotor and stator increase. Whereas the earlier seal-less pumps had been limited to ¼ hp., the Hermetik is now in production in sizes up to 10 hp. (heads up to 150 ft.), with an extension beyond this range a certainty in the near future.

Except for the laminated silicon steel magnets, the wetted parts of the pump can be built of suitable corrosion-resistant materials. The magnets themselves can be protected by plating or porcelainizing.

An internal bearing is, of course, required in this design. Where conditions permit, nylon, graphite or Teflon is used to avoid the need for lubrication. Where conventional bearings must be used, they are permanently sealed in a factory-lubricated unit.

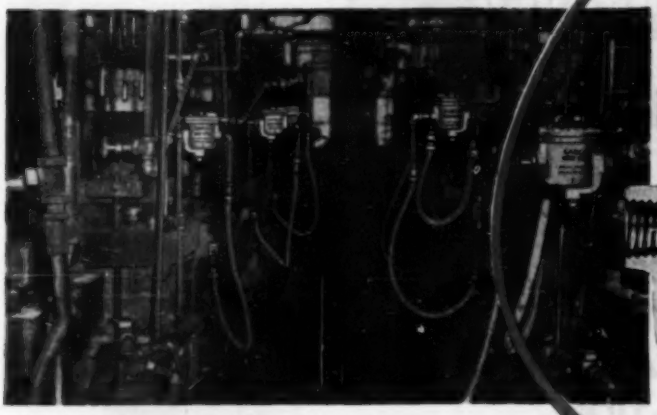
The Hermetik provides many corollary advantages in addition to the absence of the shaft seal. It is extremely compact; it can be installed in any position; it is splash-proof and explosion proof; and it requires no shaft coupling.—*Atlantic Pump Corp.*

Pipe Hanger Is Adjustable in Field

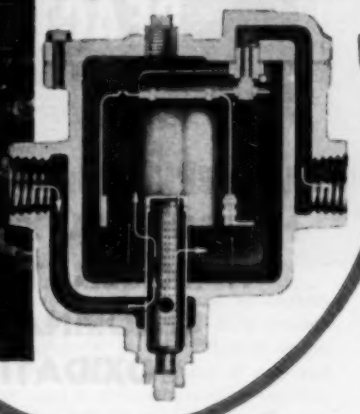
(190B) A new constant-support pipe hanger, Model L, provides simplified field adjustment, increased travel range and greater load capacity with a smaller number of springs and fewer chassis sizes. Discrepancies between calculated hanger loads and actual loads can be very simply cor-

five million

TRAP DAYS *of Satisfactory Operation with*



A few of the 100 Sarco Bucket Traps in this Plastics Plant



Here's a "test" to end all tests as far as steam traps go. More than 100 Sarco Bucket Traps in operation 24 hours a day most of the time for more than 15 years! As the manager of this plastics plant puts it "They are tops in satisfaction—what more can I say." And the mechanic who put them in and has had charge of the steam service for 22 years, says "Sarco ended our trapping problems 15 years ago."

IT COSTS LESS TO BE RIGHT — The invariable result of adding Sarco Steam Traps and Temperature Controls to improve production is a *saving in fuel costs.* Heat where you want it, when you want it — never too much — or too little or too late. To be right the first time see Sarco first.

SARCO BUCKET STEAM TRAPS

SARCO Bucket Steam Trap clears condensate instantly. And it costs less to install because of the built-in strainer (at no extra cost) and the straight-thru connection which saves piping materials, time and labor. Ask for Catalog No. 350.

310

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SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

NEW PRODUCTS
made possible through
LIGHT-INDUCED REACTIONS

SUCH AS...

POLYMERIZATION . . .
HYDROGENATION . . .
HALOGENATION . . .
CHLORINATION . . .
OXIDATION

During the last decade, many new products have appeared as the result of using light as a catalyst. Some were made possible only through the action of radiations. In most cases the long waves of ultraviolet have the strongest effect. These include some of the valuable insecticides, one of which is the popular Benzene-Hexachloride.

Photochemistry has become established as a commercially practical principle. Apparatus is designed to permit continuous flow, batch, or recycling procedure. In many instances lower cost reactors and smaller equipment can be used as compared with strictly chemical type reactions. It is important to note that larger scale production equipment may be made completely of glass thus avoiding the use of critical metals which are in short supply.

Ultraviolet radiation is a powerful photochemical agent. Reactions of many types, such as synthesis, decomposition, hydrolysis, oxidation, reduction, polymerization, bleaching, precipitation, isomeric change and halogenation result from exposure to actinic radiation. Reactions may be in vapor, liquid or solid phases.

Hanovia mercury arc lamps are very efficient sources of the ultraviolet and visible radiations proven to be effective in photochemistry. Fittings of special design permit easy and quick installation of the light tubes in the reactors.

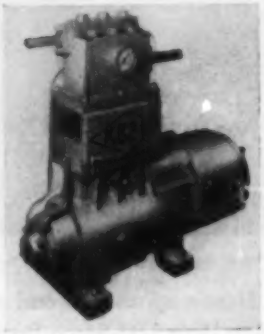
Long experience in designing lamp installations enable Hanovia engineers to be of assistance in suggesting the best equipment for specific applications.

SPECIAL PRODUCTS SALES DIVISION

HANOVIA CHEMICAL & MFG. CO.
DEPT. C, NEWARK 5, N. J.

rected in the field at the time of installation by making a simple adjustment of the position of one nut.

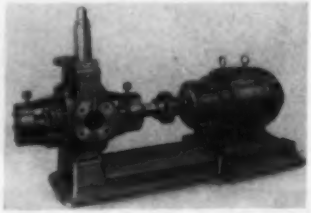
Engineers designing anchorages and providing clearances for the new hangers now have only three chassis sizes to be concerned with as against four, and the total load range, which formerly required 28 sizes, is now covered by only 16 sizes. As the load capacities and travel ranges increase from size to size there is complete overlapping of load and travel ranges; for every load there is a Model L hanger with an appropriate travel range or a choice of travel ranges. —*Grinnell Co.*



Triplex Pump
Delivers High Pressures

(192A) A compact triplex pump is made in pressure ratings up to 5,000 psi. and displacements up to 60 gpm. Special 10,000 and 20,000-psi. heads are available.

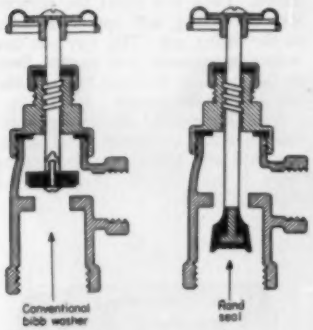
Here are some features of the new pump: Integral gears, available in a wide variety of ratios; interchangeable plungers and liners; spring-loaded balls and hardened-and-ground valve seats; built-in pressure lubrication; and integral motor drive.—*Kobe, Inc.*



Rotary Pump
For Non-Lubricating Liquids

(192B) A new positive displacement rotary pump uses the pressure of the liquid being pumped to maintain contact of the sliding vanes

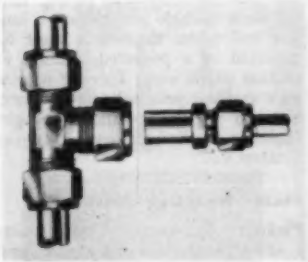
against the liner. The pump is made in both internal and external bearing designs; the external bearing model is especially suited for non-lubricating liquids such as gasoline and kerosene. —*Worthington Pump & Machinery Corp.*



Valve Seal Works With the Flow

(193A) A new cone shaped valve seal which closes in the same direction as the fluid flow takes advantage of the fluid pressure to help seal the valve. Solid particles in the fluid will not prevent establishment of a sealing line contact. This design makes possible a valve that is claimed to be leak-proof, long wearing, easier operating and comparatively inexpensive to manufacture.

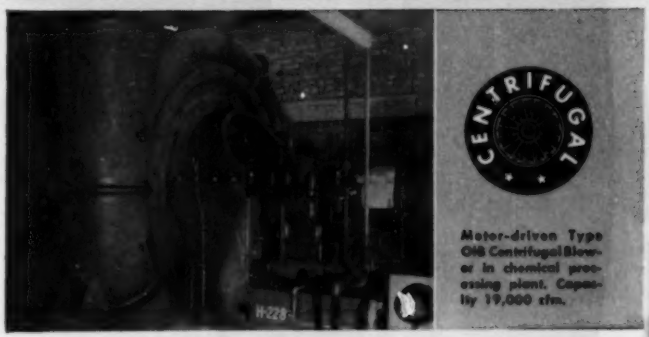
The cup-shaped conical washer surrounds an imbedded metal plug which eliminates bending and warping. The rubber member of the seal is specially compounded to withstand oil, grease, steam, water and most industrial chemicals.—*Rodic Chemical & Rubber Corp.*



Reducer Fitting Connects Different Sizes

(193B) The new Swagelok reducer fitting enables you to join different sizes of tubing. It consists of a body, two ferrules and a nut. The two ferrules, plus the threaded chuck inside the nut, clinch tightly around the tubing wall and provide a tight seal. *(Continued)*

Keep your eye on V·P·I
WHEN SELECTING
BLOWERS



You can't afford to risk shutdowns today because of unsatisfactory or inadequate equipment performance. To keep production moving at the required fast pace, calls for blowers or gas pumps that continuously deliver positive Volume at required Pressure—and at Low power costs to reduce operating expense.

You get these 3 essentials from R-C Blowers and Gas Pumps. Whether your needs call for Centrifugal or Rotary Positive units, we can match them from our exclusive *dual-ability line.* With capacities from 5 cfm to 100,000 cfm, you can usually find R-C units that closely fit your demands, with resultant savings in time, cost, space, weight and power.

From an experience of almost a century of blower building, our engineers will gladly make suggestions of the right R-C equipment to move or measure gas and air to keep production going.

ROOTS-CONNERSVILLE BLOWER CORPORATION
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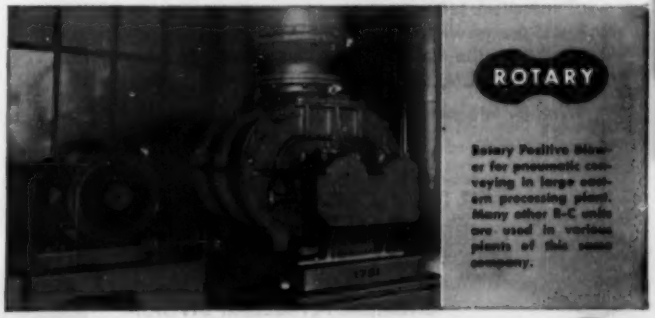
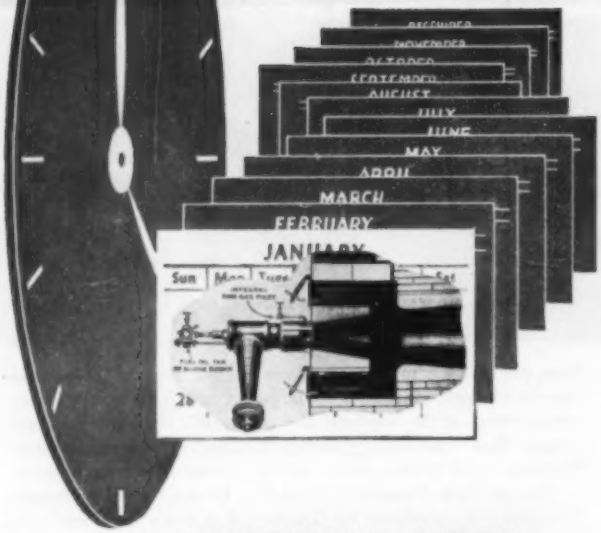

ROTARY
Rotary Positive Blower for pneumatic conveying in large eastern processing plant. Many other R-C units are used in various plants of this same company.

ROOTS-CONNERSVILLE
BLOWER DIVISION
ONE OF THE DRESSER INDUSTRIES

10,000 HOURS

WITHOUT SHUTDOWN!



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OIL-GAS TANDEM COMBUSTION UNITS

Call it 10,000 hours, 417 days, 60 weeks or 13 months, but *remember . . . it's an average "on stream" run . . . without shutdown . . .* for NATIONAL AIROIL oil-gas Tandem Combustion Units. Long runs being economically essential in the operation of a modern refinery, and *extra long* runs (to over 10,000 hours) are assured with NATIONAL AIROIL Tandem Units. You will realize *higher profits* from your oil heaters when you specify NATIONAL AIROIL oil-gas Tandem Combustion Units.

Write for information on your business letterhead.

PRODUCTS:

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes; STEAM ATOMIZING OIL BURNERS; MOTOR-DRIVEN ROTARY OIL BURNERS; MECHANICAL PRESSURE ATOMIZING OIL BURNERS; LOW AIR PRESSURE OIL BURNERS; GAS BURNERS; COMBINATION GAS and OIL BURNERS; AUTOMATIC OIL BURNERS, for small process furnaces and heating plants; FUEL OIL PUMPING and HEATING UNITS; FURNACE RELIEF DOORS; AIR INTAKE DOORS; OBSERVATION PORTS; SPECIAL REFRACTORY SHAPES.

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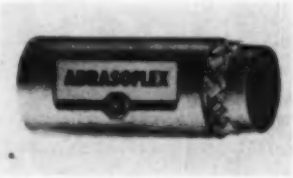
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

It is not necessary to perform any preparatory steps on the tubing. You simply insert the tubing into the reducer, apply 1¼ turns to the reducer nut, and the first assembly is completed. Then you insert the reducer into the fitting and apply 1¼ turns to the fitting nut. This way you can reduce instrument and process lines to the required diameter both on the run and on the branch.

Swagelok reducer fittings are available in brass, aluminum, steel, stainless steel and Monel in sizes ranging from ¼ to ⅞ in. O. D.—*Crawford Fitting Co.*



Neoprene Hose Resists Oil and Abrasion

(194A) A new neoprene industrial hose can be used for air, water, paint spraying, oil spraying, grease and gasoline. Known as Abrasoflex, it is said to be especially resistant to abrasion. Its versatility makes it unnecessary to keep an inventory of several types of hose for different services.—*Mercer Rubber Corp.*

Atomizing Nozzle For In-Line Mounting

(194B) A new pneumatic atomizing nozzle can be mounted in line with the connecting piping. This feature is valuable where space is limited and where the nozzle must be mounted in a projected position in relation to the work. Previous nozzles were available only with pipe connections in opposed positions at right angles to the line of spray.—*Spraying Systems Co.*

Fluids Handling Briefs

Packaged Compressor—Unit consists of a steam turbine and a centrifugal compressor mounted directly on a surface steam condenser. Condensate pumps and ejectors are included. Saves on foundation costs and installation expense. Ingersoll-Rand. *(194C)*

Iron Valves—New line offers features formerly found only in steel valves. Ohio Injector Co. *(194D)*

—End

BACK IN THE 1880's

WHEN THE INVENTION OF CELLULOID FILM PAVED THE WAY FOR MOTION PICTURES

Koven

WAS MAKING INDIVIDUALIZED CHEMICAL EQUIPMENT

72" dia. x 20' Long Horizontal Tank

Aluminum Steel Tanks and Condenser

Celluloid Film accelerated a great cultural medium—Motion Pictures. But even before the first star was born—KOVEN Individualized Chemical Equipment was pleasing [illegible]. Today—over 70 years of [illegible] as one of America's leading steel fabricators—enables us to cut costs and up production [illegible] equipment to fit the most exacting needs.

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KOVEN FOR INDIVIDUALIZED CHEMICAL EQUIPMENT SINCE 1881

AUREOMYCIN plant required acid and alkali proof Lecite-glass cloth membrane beneath brick joined by Lecite mortar.

PICKLING tank for wire required sulphuric acid proof brick lining.

New Cements Resist Alkali Too

Use of furfuryl alcohol resins in cements has sharply increased their corrosion resistance. They're now rapidly moving in on a whole new set of CPI applications. (196A)

Corrosion-resistant cements are making a fresh splurge in the CPI. The newer ones have far greater alkali resistance and will stand up under higher temperatures than ever before; and their acid resistance is as good, if not better. The payoff is an unprecedented diversity of applications.

Furfuryl-alcohol resins take the credit. As bonding agents they bypass restrictions on the old phenolic-type resins which produce cements that are primarily acid-proof and not alkali-proof.

It has been a little over two years since Electro Chemical Engineering and Mfg. Co. brought out its Lecite cement—a liquid furfuryl-alcohol resin binder and a powder consisting of a filler and the chemical setting agent. There are a fast-growing number of success stories on its use in lining equipment and storage vessels handling acids, alkalis and solvents. It serves as mortar for corrosion-proof brick lining and as an impervious liner when reinforced with glass cloth or expanded metal mesh. In plants where a chemical-proof brick or tile floor is required, these impervious membranes are used between the concrete-subbase and brick or tile. In addition, Lecite is used to join the tile.

The Lecite-glass cloth membrane is one of the newest uses. About ⅛ in. thick, it is serving not only as a lining but in some instances by itself in formed shapes.

Corrosion-resistant cements like this are required in plants producing organic chemicals, phenol, alcohol, nylon, copper sulphate, acids, textiles, steel, soft drinks, soap, food and dairy products. They are being used in chemical process equipment such as reactors, filters, towers, alkylators, neutralizing tanks, stacks and fume ducts. They also go into pump foundations, floors, pickling tanks for steel. In one plant, a brick-lined reactor is handling a mixture of hydrochloric acid and organic solvents at an operating temperature of 350 deg. F. and a working pressure of 40 psi. In another, dilute sulphuric acid at 70 lb. steam pressure is passed through a digester.

Furfuryl-alcohol resins are readily compatible with asphaltic compounds. When used in small percentages, they serve to improve the wetting properties of such compounds for fibrous fillers as cotton and asbestos. For instance, they are used in asphalt battery box formulations to insure better penetration of the cotton reinforcement.

Lecite is inert to all acids except for a few strongly oxidizing chemicals. It is inert to all alkalis of all concentrations and to practically all of the organic solvents, oils and greases. It will withstand temperatures up to 370 deg. F. It has a tensile strength of 1,000 psi. and a compressive strength of 10,000 psi. It adheres to brick or other ceramic surfaces with a bond of over 700 psi.

Electrochemical Engineering & Mfg. sums up the following use-tested advantages of its product over comparable materials:

1. May be stored indefinitely
2. Longer working time without sacrifice of speed of final set
3. Will set under damp conditions and at temperatures as low as 45 deg. F.
4. Greater resistance to solvents and oxidizing conditions

Furthermore, Lecite is available in compositions having high or low electrical resistivity and high or low heat conductivity.

Research by both furfuryl resin and cement producers is still bringing forth improvements in impact strength and shrinkage properties, in adhesion to ceramics, concrete, metals, glass, cloth and rubber. Market development is expected to continue apace.

Cation Exchangers

Depend on the phosphonic and phosphoric acid groups for their activity. (196B)

Interesting characteristics as adsorbents as well as cation exchange resins have been shown by new types of cation exchangers developed by Chemical Process Co., Redwood, Calif. To get the complete picture, research on both the phosphoric and

phosphonic groups is still under way. In general, the exchangers are expected to find a niche for themselves in hydrogen ion cycle processes.

As might be expected from the nature of the exchange groups, two different levels of activity are observed. The first hydrogen ion is moderately strong and hence splits salts in much the same way as does the sulphonic acid group. The second hydrogen ion is quite weak and comes into action only at high pH's.

The strength of the new exchangers is intermediate between the two exchangers now on the market—sulphonic and carboxylic acids. Because of this and the high cost of the new products, they will not compete directly with either. Strictly as an estimate, depending on the demand that develops and the price of phosphorus, the new cation exchangers will cost about $30 per cu. ft.—more expensive than any sulphonic acid exchangers now on the market. One factor in the high price is a corrosion problem encountered in the manufacturing.

Accordingly, the new products will have to find a demand which only they can satisfy. Two uses seem to be indicated from early results of investigations carried on by Chemical Process and potential customers. One involves a therapeutic use in the treatment of water absorption by the body. This absorption is known to be related to the sodium ion concentration in the body. Current treatment involves a salt free diet and large dose of carboxylic acid exchangers. Because of the higher strength of the phosphonic group, this dosage could be cut down by using the new exchangers. Toxicity tests are being carried on at present by pharmaceutical houses.

The other use presently envisioned involves the high selectivity and complexing properties of the phosphonic group. Separation of the rare earths and traces of many metallic ions might be facilitated through techniques developed around the new exchangers.

The products are immediately available. Samples can be had by anyone for carrying on experimentation.

Gasoline Additive

Lead scavenger, a tricresyl phosphate formulation, cuts spark plug fouling in aircraft engines. (197A)

Flight tests have clearly indicated that a new aviation gasoline additive developed by Shell Oil Co. virtually eliminates spark plug fouling.

IN BRIEF—A capsulated listing of this month's newsworthy products

It's New . . .	It's Good For . . .	See Page . . .
Resin Cements	Resisting alkalis and solvents as well as acids	196A
Cation Exchangers	Separation of rare earths, traces of metallic ions	196B
Gasoline Additive	Cutting spark plug fouling in aircraft engines	197A
Polyamide Resins	Water and grease proof coating for paper	197B
Blowing Agent	Use with either natural or synthetic rubber	197C
Lubricant	Puncture-proof, light weight panelling	198B
Wood Product	Hydraulic brake fluids	198A
Aluminosilicates	Resisting thermal shock	198C
Alkyd Resin	Rust-resistant, fast-drying finish	198D
Viscose Treatment	Permanently altering qualities of rayon fibers	198E
Rust Preventative	Protecting metal surfaces with vapor	200A
Synthetic Fiber	Mildew, abrasion and wear resistance	202A
Coating Process	Making stainless resist oxidation under high heat	202B
Glass Cloth	Motor and Cable insulation	202C
Maleic Hydrazide	Slowing down growth of grass	202D

Don't Forget: Reader service postcard inside back cover will bring you more information. Use these key numbers

Researchers had narrowed the cause of the fouling down to the presence of metallic lead. Although the ethylene dibromide, normally incorporated in the fuel, removed the bulk of it from the combustion chamber, enough was left to cause the trouble. So experiments were started to find a supplement for EDB.

Success came when they incorporated the common plasticizer, tricresyl phosphate, in a new scavenger formulation. The additive produced an 1,100 percent increase in foulless operation in the engine used for their tests.

It was also indicated that the special scanvenger may materially reduce exhaust valve crown corrosion which is a problem in service. Various physical and chemical tests were run to assure that the performance with respect to stability, and corrosion rubber swell would not create new problems. In fact the product is still under evaluation and final quantitative results must await several months of continued flight testing.

Polyamide Resins

Better solvent resistance, longer gel time, unusual adhesiveness are bonus properties of some members of a new series. (197B)

Better solvent resistance and a higher melting point set new resin No. 90 apart from older General Mills heat sealing polyamides. Like them, it is resistant to greases, oils, water and water vapor, alkalis, mild acids and many organic solvents.

Tough, hard and brittle polyamide resin No. 90 is the product of the copolymerization of di- and trilinolcic acid and other acids with ethylene diamine. When properly plasticized, it makes an effective water, water vapor and grease proof coating for paper and other materials. It can also serve as a coating for electrical units and shows promise as a molding compound and binder.

Adding a small amount of antioxidant to resin No. 90 or to other General Mills polyamides produces series members 90S, 93S, 94S and 95S. At high temperatures, these stabilized resins have a gel time approximately three times longer than the standard polyamides themselves. Their heat resistance makes these stabilized polyamide resins suitable for hot melt applications.

Polyamide resin 100S, the final member of the new series, is a soft tacky, plasticizing type of resin. To make it, dimerized and trimerized unsaturated vegetable oil fatty acids are condensed with diethylene triamine.

Unusual adhesive properties are said to make it particularly suitable for non-porous surfaces. It adheres well to metals, glass, cellophanes, Saran film and cellulose acetate as well as to paper, rubber and leather. Compatible with a wider range of materials than other polyamides, it is a potential plasticizer for many resinous products now on the market.

General Mills claims that all members of the new series may be used alone or as modifiers for other resinous products. All of them are now available in commercial quantities.

Blowing Agent

A natural for the manufacture of vinyl plastic sponge. (197C)

Here's a chemical blowing agent that can be used with either natural or synthetic rubber, a variety of plastics and the new rubber-plastic blends. Known as Celogen, it has been put into commercial production by the Naugatuck Chemical division, U. S. Rubber.

It is particularly suited for the manufacture of vinyl plastic sponge. The resulting product is unusually buoyant, weighs 6 to 8 lb. per cu. ft., is flame-

proof, and ranges from a rigid to soft structure. Tests indicate that it is non-toxic.

Sponge rubber made with the chemical has a fine, uniform cell structure of either the open pore or closed pore type. The sponge can be non-staining, non-discoloring and odorless.

Because of its high decomposition point, Celogen can be added to relatively hot stocks on a mill without danger of a premature blow. It is a stable white powder at normal temperatures but decomposes at temperatures above 135 deg. C. with the liberation of nitrogen gas. Chemically, the blowing agent is p,p'-oxybis (benzene sulfonyl hydrazide).

Lubricant

Combines best properties of polyethylene glycols and polypropylene glycols. (198A)

A new chemical for use as a lubricant in hydraulic brake fluids and as an intermediate for surface-active agents has been put into commercial production by Dow Chemical Co. Known as Polyglycol 15-200, it is a water soluble liquid derived from polyalkylene oxides.

Polyglycol 15-200 may be described as a chemical hybrid between the polyethylene glycols and polypropyleneglycols. It has inherited some properties from each: good solubility in both water and organic liquids, high flash point, low pour point, excellent viscosity-temperature relationship, and low skin toxicity.

Based on pilot plant quantities now being used, the product is expected to show utility as a general, water-soluble, industrial lubricant with potential in rubber molding and metal working operations. It should also be useful as a solvent and carrier, especially in the cosmetic field.

Wood Product

Panelling that is puncture-proof, rigid and dimensionally stable, split-proof and relatively light weight. (198B)

Plyron, a new building material combining two wood products, has been announced by Douglas Fir Plywood Assn., Tacoma, Wash.

Plywood, made by gluing thin sheets of wood together, is faced with hardboard, a tough tree product made by chewing wood waste into tiny pieces and putting it under pressure. The result is a panel that is puncture-proof, rigid and dimensionally stable, split-proof and relatively light weight.

Plyron already has been proved successful for such diverse applications as concrete forms, cabinet doors, table tops and flooring. At present being made in $\frac{1}{8}$ and $\frac{3}{8}$ in. thicknesses, it can be made thicker or thinner. The price is about 20 percent higher than that for comparable thicknesses of plywood sanded on both sides. Ten of the plywood industry's 70 plants are producing the new material, and others are experimenting with it.

Although Plyron is a new departure for plywood manufacturers, it can be made with present equipment, since hardboard replaces veneer as the outer plys of the panels. At present the hardboard is being supplied by Masonite Corp., Chicago, although the Northwest's expanding hardboard industry may eventually be the supplier.

Lithium Aluminosilicates

Ceramics, highly resistant to thermal shock, suitable for pickling bath containers, furnace liners, nozzle inserts. (198C)

A series of new ceramic materials able to withstand extreme thermal shock—primarily through exceptionally low coefficients of expansion—has been developed by Stupakoff Ceramic & Mfg. Co., Latrobe, Pa. Identified as Stupalith, this material is being produced commercially in two principle types: with "zero" thermal expansion and with near-zero thermal expansion, either plus or minus.

Its ability to withstand thermal shock makes it particularly adaptable for pickling bath containers, kiln furniture, induction heating. Since its expansion can be controlled, it also is suitable for furnace liners and thermostat core rods. In addition, parts made from "zero" expansion Stupalith can be used for plug-and-ring gages, turbine blades and jet turbines, nozzle inserts.

This new material can be used at temperatures up to 2,400 deg. F., and is believed by the manufacturer to remain stable indefinitely. Samples have been held at 2,000 deg. F. for periods of 120 days with no detectable changes in specific gravity or other characteristics.

Basically a wide series of lithium aluminosilicate compositions, the Stupalith group ranges from oxide compositions equivalent to the mineral eucryptite, the mineral petalite. Certain other compositions closely allied to the lithium aluminate-silica also are considered part of the Stupalith group.

Alkyd Resin

Used to coat panel, left, it withstood 20 percent salt spray for 300 hr. Rusted and corroded panel was coated with a popular alkyd primer. (198D)

Designated as G-E Glyptal 7422, General Electric's new paint resin is a short, pure, oil-modified alkyd, free of rosin, phenolic, styrene, or other modifiers. It has drying speed formerly unattainable in straight oil-modified alkyds. In 5 to 10 min. it air dries dust-free, and in 3 to 4 hr., tack free.

The resin is recommended for a variety of industrial finishes requiring fast air-dry or very rapid bake—appliance and furniture finishes, primers, automotive and metal cabinet finishes. Exposure tests on gloss paints in New York and Florida show that Glyptal 7422 has higher gloss retention and chalking resistance than any other Glyptal alkyl resin of similar oil length.

Unlike conventional short-oil alkyds, it has a high tolerance for aliphatic thinners. Enamels based on 7422 may be safely thinned with proportions as high as 200 percent naphtha and petroleum spirits without danger of precipitation or instability. Also, tests in G-E laboratories show that for baking enamels, amine resin requirements can be reduced 30 to 50 percent without lowering hardness below that of conventional baking alkyds. Finishes formulated with 7422 can be made to perform like styrenated alkyds without such disadvantages as after-tack, poor solvent and mar resistance.

Viscose Rayon Treatment

"... chemical reagent completely alters the molecular structure of the rayon fiber to give it qualities it never had before." (198E)

These qualities, according to President Russell B. Newton of Dan River Mills, double the wear life of rayon, assure permanent shrinkage control,

"Sweet solution" to a filtration bottleneck

Gearing sugar production to meet ever-increasing demands is a problem that the sugar industry actually solved years ago when they eliminated filtration bottlenecks by starting to use Celite* filter powders.

Sugar refiners found that pressure filtration, using Celite, completely removed colloidal matter at high flow rates for long, uninterrupted cycles.

Celite's ability to do an exceptional filtering job can be attributed to these important factors which make it unique among filter aids:

Carefully processed from the purest deposit of diatomaceous silica known, Celite is available in nine standard grades—each designed to trap out suspended impurities of a given size and type. Whenever you reorder, you are assured of the same uniform, accurately graded powder received in your initial order. Thus, with Celite, you can count on consistent clarity in your filtrates—at highest rate of flow—month after month, year after year.

Helping sugar producers to get faster production is just one way in which Celite has improved operations for many industries. The proper grade of Johns-Manville filter aid will assure you the same results. To have a Celite Filtration Engineer study your problem and offer recommendations, simply write Johns-Manville, Box 290, New York 16, N.Y. *No cost or obligation.*

*Reg. U.S. Pat. Off.

JM PRODUCTS

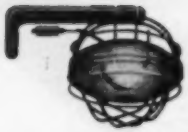
Johns-Manville CELITE

FILTER AIDS

Which do YOU need to protect YOUR business from FIRE?

Kidde Multi-Jet Nozzle. The "business end" of a Kidde CO_2 fire extinguishing system. It blankets flame with fire-smothering carbon dioxide.

Kidde Dry Chemical Wheeled Extinguisher. A "one man fire engine" to control large fires in flammable liquids, live electrical equipment.



Kidde "Heat Detector". 24 hours a day this sensitive detector stands guard ready to set off a Kidde CO_2 system automatically if fire should strike.

Kidde Carbon Dioxide Portable. Fast-acting . . . easy to use. A pull of the trigger releases a rolling fog of CO_2 gas that smothers flame instantly.

Kidde Smoke Detector. A new development in industrial fire fighting. Detects hidden smoldering fire, tells in which room or vault it is located.

Kidde CO_2 Hose Reel Equipment. Combines the convenience of a portable fire extinguisher with the great fire-killing power of a built-in system.

Kidde Trailer. An economical, fast-acting unit for thorough-going fire protection in smaller plants and airports and auxiliary protection in larger ones.

Kidde Chemical Extinguishers. Foam, Soda-acid or water portable extinguishers in stainless steel. Two-and-a-half gallon capacity. Easy to use, reliable, economical.

Kidde Vaporizing Liquid Extinguisher. Approved for fires in flammable liquids and electrical equipment. Discharges carbon tetrachloride.

For many years Walter Kidde & Company, Inc. has specialized in fire extinguishing equipment. It ranges from 2½ pound portables to huge built-in systems. Need advice on protection for your plant? Call or write Kidde.

Kidde

Walter Kidde & Company, Inc.,
1228 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

offer wrinkle resistance, guard against yellowing of white fabric.

The job is done by Dan River's new X-2 chemical treatment. The reagent used stabilizes the cross linkages in the molecular structure of the rayon fiber. Flex-life and flat abrasion resistance of viscose are said to be extended up to four times that of resin finished rayons.

Appearance of these cloths is not affected in any way by the process. But stretching, like shrinking, is stabilized and controlled. X-2 rayon does not have the tendency of resin-treated rayon to absorb chlorine from household and commercial bleaches used in laundering. The chlorine retention often results in breakdown of the fabric.

The X-2 process can be applied on standard equipment. It is already in use at Dan River Mills. Because of its broad commercial implications, the company will soon make it available to the whole industry.

Rust Preventative

Its vapors provide protection without coating for metal surfaces. (200A)

A slightly volatile amine nitrate is now being offered to industry by Shell Oil Co. to prevent rust and corrosion of metal parts in the presence of air and moisture. The powder-like substance known as VPI gives off vapors which are carried by convection and diffusion to all surfaces of the metal. They condense to a thin protective layer. This layer not only protects but is said to inhibit corrosion at any advanced stage.

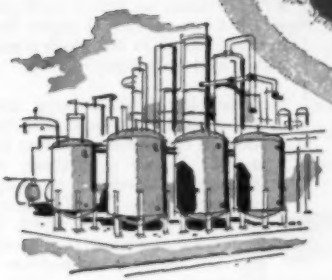
Economy heads the list of advantages claimed for the new corrosion inhibitor. Relatively small quantities, established by practice, are required to give adequate protection. For instance, when properly used with a barrier to prevent loss of vapor, one gram of VPI is said to guard a cubic foot of metal parts for as much as a year. Solutions of from 2 to 4 percent are effective in protecting processed metal parts.

Field tests during shipment, storage and various processing steps have shown it to be effective for metal parts, assemblies and finished products. Method of use is flexible enough to accommodate the varied range of applications. It can be applied by placing it in a package enclosing the parts to be protected (as in an envelope containing ball bearing races); by blowing it into an area to be protected (as in the aircraft engines where it is blown into spark plug holes and

did you know...about Carbide's

POLYETHYLENE GLYCOLS'

Versatility? Quality? Availability?



Carbide and Carbon's experience in the production of polyethylene glycols assures you that these products meet rigid quality controls and guaranteed high quality. These polyethylene glycols are available for immediate shipment in four closely controlled molecular weight ranges—200, 300, 400, and 600. Solid polyethylene glycols with molecular weights of 1000-6000 are marketed as CARBOWAX Compounds.

These water-white, non-volatile liquids are *truly* versatile chemicals. They are humectants, solvents, and lubricants and yet are completely soluble in water. These products are heat-stable, inert to many chemical agents, and do not hydrolyze or deteriorate on standing. They are powerful solvents for dyes, drugs, resins, proteins, and other difficultly soluble materials, and leave no residual odor in end products. The polyethylene glycols are much less volatile than glycerol and are 40 to 70 per cent as hygroscopic. Within that range you can get any humectancy you need. In addition, the two hydroxyl groups can be esterified with organic acids. The diesters of fatty acids form plasticizers with good low-temperature properties and the monoesters form excellent surface-active agents that are not affected by mild acids or hard water.

IT'S EASY to see how these polyethylene glycols can serve you. Try them in your manufacturing process wherever polyols such as glycerol are used. Just call or write our nearest office for trial samples and additional technical help.

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COUNT THE WAYS THEY CAN HELP YOU AS...

Humectants	Intermediates for:	Non-Ionic Surface-Active Agents
Lubricants		Suspending Agents
Solvents		Thickening Agents
Couplers		Foam Stabilizers
		Plasticizers

The term "Carbowax" is a registered trade-mark of Union Carbide and Carbon Corporation.

Sure we're up-to-date in water pre-treatment.

(see opposite page)

BUT DO YOU KNOW WHAT WE CAN DO FOR YOU IN

ION-EXCHANGE?

Dorrco D-I System installed at a Norwegian Chemical Plant.

for instance, do you know that . . .

DORR *can place at your disposal* any portion of a complete service for handling ion-exchange problems . . . from problem analysis to initial plant operation.

DORR *can supply equipment* for the treatment of water, and chemical or sugar bearing solutions of all kinds; for the extraction and concentration of some of the valuable metals from dilute solutions . . . in any capacity you require.

DORR *will work with you* on any phase of your ion-exchange program . . . whether it involves established principles or a new and confidential process.

If you are currently exploring the possibilities of ion-exchange for new processes or those already established we believe we can help you. And you'll find our ion-exchange facilities backed by solid chemical engineering knowledge.

Bulletin #4081 lists the high-spots of Dorrco D-I* Systems. Write to Ion-Exchange Sales, The Dorr Company, Barry Place, Stamford, Conn.

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NEW PRODUCTS, cont. . .

other ports); by putting it into a water or alcohol solution (as in the protection of metal parts during and between processing steps such as grinding) and covering the metal parts in tote boxes.

When using VPI, ventilation of the enclosure in which parts are stored should be kept to a minimum to insure the maximum protection period. The parts should be no further than 2 ft. from the VPI source.

Two types of VPI are available: VPI 220 which has greater vapor pressure but less stability at higher temperatures than VPI 260 which is more widely used by industry.

New wool-like fabric is being made on a limited commercial scale by a chemical conversion of cottons and rayons. Known as Stazenu, the product was developed by Joseph Bancroft & Sons Co. of Wilmington. The processes by which the fabrics are produced permanently alter the chemical composition of cellulose (for example, in cotton or viscose rayon cloths) and the properties of the resultant fabric are the properties of the cellulose derivatives rather than the original cellulose. These properties include: lively, wool-like crimp of individual fibers; mildew, abrasion and wear-resistant; slow-burning, moth-proof; warm to the touch. *(202A)*

Coating process which enables stainless steel to resist oxidation under high temperatures has been licensed to Ferro Corp., Cleveland. Ferro will manufacture and market the coatings on an exclusive basis according to an agreement with the developers, Solar Aircraft Co. *(202B)*

Silicone rubber treated glass cloth for motor and cable insulation is now in production at General Electric's Coshocton, Ohio, plant. In the dipping process that is used, glass cloth is passed through a liquid solution of silicone rubber. *(202C)*

Maleic hydrazide is a new chemical which slows the growth of grass. Its developers, Naugatuck Chemical division, expect it to slash millions of dollars annually from the cost of mowing the roadsides and center islands of public highways. They are backed up extensive field tests which also show that maleic hydrazide could be formulated with 2,4-D weed-killer. Then one spray would not only slow the growth of desired grasses but would kill off objectionable weeds. *(202D)*

—End

Process water supply problems solved! with...

Dorrco Hydro-Treators*

A constant supply of clear process water is a key ingredient in most production flowsheets. Too much hardness, turbidity, color or algae can mean trouble all through the plant. Here's the kind of results that four industrial plants** are currently getting from Dorrco Hydro-Treators. We believe they speak for themselves.

	PLANT A	PLANT B	PLANT C	PLANT D
OPERATION	COLOR REMOVAL	COAGULATION	COLOR REMOVAL	TURBIDITY REMOVAL
NO. AND SIZE OF UNITS	2—80' DIA.	1—75' DIA.	2—100' DIA.	2—90' DIA.
CAP. PER UNIT-MGD	10.0	6.5	10.0	12.6
AVG. EFF. PPM	3—5 (TURB)	3 (TURB)	10 (COLOR)	TRACE
SLUDGE % SOLIDS	—	21.6	—	—

If you are investigating high-rate, up-flow type units for your process water supply, get all the facts before deciding. A new 32 page bulletin in color, #9041, describes the Hydro-Treator in detail. For your free copy write to The Dorr Company, Stamford, Conn., or in Canada to The Dorr Company, 80 Richmond Street West, Toronto 1.

One of two 90' dia. Dorrco Hydro-Treators which treat 25 MGD of process water for a large pulp mill.

* Trade Mark, Reg. U. S. Pat. Off.

** Names on request.

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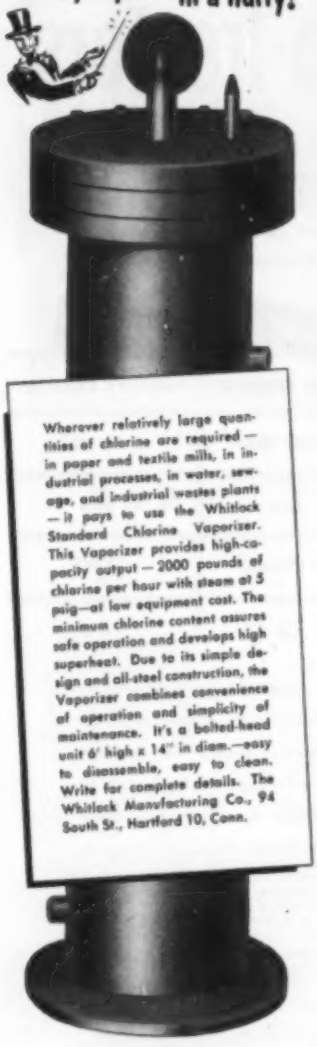
Presto Change-o

Whitlock Chlorine Vaporizer converts liquid chlorine to dry vapor - in a hurry!



Wherever relatively large quantities of chlorine are required — in paper and textile mills, in industrial processes, in water, sewage, and industrial wastes plants — it pays to use the Whitlock Standard Chlorine Vaporizer. This Vaporizer provides high-capacity output — 2000 pounds of chlorine per hour with steam at 5 psig—at low equipment cost. The minimum chlorine content assures safe operation and develops high superheat. Due to its simple design and all-steel construction, the Vaporizer combines convenience of operation and simplicity of maintenance. It's a bolted-head unit 6' high x 14" in diam.—easy to disassemble, easy to clean. Write for complete details. The Whitlock Manufacturing Co., 94 South St., Hartford 10, Conn.

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In this business of dust control—like many others—experience is the best teacher. We have been learning for 50 years—and still are.

With thousands of installations, we have a wealth of experience in all industries. We'd like to share this wealth by discussing your particular problem with you. Sly representatives are trained and experienced engineers.

There's no obligation involved. You may be agreeably surprised at how *effectively* and *inexpensively* your dust problem can be solved. Ask for Bulletin 98.

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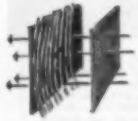
...not that our wire cloth looms can weave spider webs, but, like the spider we are sometimes called upon to produce special weaves for specific tasks.



For example—a textile processor needed a wire fabric that would: **1.** resist corrosion, **2.** permit the passage of refrigerated air, **3.** provide a dark background against which broken fibres would be easily visible. Solution: we produced a 50-mesh bronze cloth, chemically colored it black. It filled the bill.

For many years we have supplied another customer with a cloth woven from a specially-drawn, fine silver wire for use in a delicate chemical process. The customer supplies the wire; we supply the craftsmanship.

Another customer wanted cloth woven from lead wire, always a difficult problem because lead itself is so soft. Yet, close attention by the loom operator and close control of the weaving speed successfully completed the order.

Whatever your requirements for industrial wire cloth . . . standard or special types . . . you can rely on our experience for your guarantee of top workmanship, exact adherence to specifications and quality materials when you specify . . .

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Write for free wire cloth reference manual. Gives metallurgical data, uses and specifications for industrial wire cloth users.

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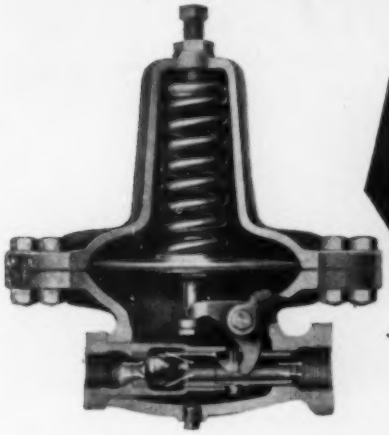
CASH STANDARD *Streamlined* PRESSURE **REDUCING VALVES** TYPE 1000

THESE TROUBLEMAKERS FIND NO OPPORTUNITY TO PERFORM WITH THE "1000" ON THE JOB



A MANUFACTURER CHECKS THE 10 POINTS AND SAYS . . .

"We have 3 of these '1000' valves and all of them are giving good service."

THE 10 POINTS ARE CHECKED BY A RESEARCH FOUNDATION, THEY SAY

"These valves have been VERY SATISFACTORY BOTH IN OPERATION and MAINTENANCE. The MAINTENANCE COST IS ABSOLUTELY NOTHING once this '1000' valve is installed. Wherever any one may need CONTROLLED PRESSURE IN EITHER STEAM, AIR, or ANYTHING—this CASH STANDARD '1000' valve can be relied upon to do just that and TO GIVE CONTINUED TROUBLE-FREE service."

A MEAT PACKER SAYS IN CHECKING THE 10 POINTS . . .

"Very little maintenance required."

A STEEL CASTING CO. CHECKS THE 10 POINTS—THEY SAY . . .

"We find your CASH STANDARD Streamlined Type '1000' Pressure Reducing Valves to be VERY RELIABLE. We have a number of these valves in service throughout our plant, and have NEVER HAD ONE OUT OF SERVICE for any reason. These '1000' valves have been in service for approximately five years."

A MOULDED PRODUCTS CO. CHECKS THE 10 POINTS AND SAYS

"Maintenance time and cost very low."

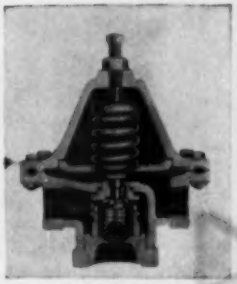
These are the Points **USERS CHECK WITH . . .**

1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

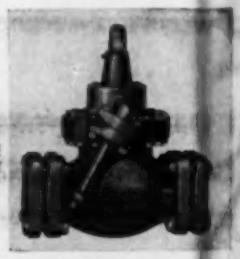
WRITE FOR BULLETIN 962

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 936—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressure.

Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

1 Magnesium oxide is charged into 2,500 gal. of water in the carbonators and there reacted with carbon dioxide.

2 After the basic carbonate is formed the slurry is mixed with asbestos fibers lightly milled in an attrition mill.

Precision Magnesia Insulation

A CHEMICAL ENGINEERING PICTURED FLOWSHEET

Ehret Magnesia Mfg. Co., at Valley Forge, Pa., has completed a year of successful operation of its new plant for making precision self-set 85 percent magnesia insulation. The process used, licensed from Pabco Products, Inc., is similar chemically to that employed by four of the six magnesia insulation manufacturers. However, the mechanical and control aspects of the process differ in many respects, having been developed by Ehret in cooperation with The Kuljian Corp., Philadelphia, engineers and constructors of the new plant.

In transferring operations to the new plant it was possible to utilize an old building for the drying, finishing, packaging, storing and shipping phases of the process. A new building houses the power plant, chemical and molding operations. All equipment is new.

Raw materials for the process are sea-water magnesium oxide, Canadian and African long-fiber asbestos in suitable proportions, 55 deg. F. spring water, and 10-12 percent carbon dioxide obtained by washing and cooling the boiler stack gases. Practically all operations are under either remote manual control, or are fully automatic, so that operating labor is greatly reduced.

The process starts with one of the eight carbonation tanks, which is charged with 2,500 gal. of cool water and 640 lb. of MgO under constant recirculation. The water may be either fresh or partly filtrate from a previous batch. Carbon dioxide is blown through the batch until a rise of CO_2 in the vent, as shown by a meter, plus a laboratory check, indicate the desired conversion to the normal carbonate. The batch is then pumped to a filter feed tank and mixed with asbestos which has been partially opened by light milling in an attrition mill. The agitated mixture drops to a rotary vacuum filter from which the solids, repulped with a metered quantity of fresh cool water, discharge to one of two rotating tilting mixers. All operations to this point are conducted by one man, largely through remote manual control.

The batch is now distributed to preheaters and molding machines by fully automatic equipment. A travelling weigh larry carrying two conical hoppers is the heart of this operation. Automatically the larry positions itself under one of the two mixers, receives a charge in each hopper (corrected for tare), then moves down the line of 14 preheaters charging them two at a time with a quantity of slurry accurate to 1 lb. The preheaters are small automatically controlled rotary tilting autoclaves in which the charge is quickly heated by live steam from about 90 to about 140-150 deg. F. to start the conversion of the normal carbonate to the self-setting basic carbonate. The preheaters then automatically tilt and discharge to the hoppers of the corresponding molding machines.

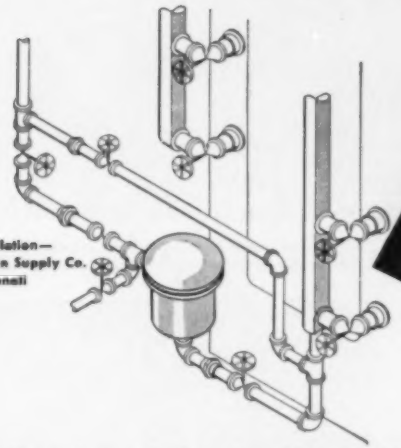
The slurry now drops into the water-heated mold cavity as it is agitated by oscillating fingers to remove the air and orient the fibers. The fingers are withdrawn and the mixture sets at 180-200 deg. F., finally being ejected from the cavity hydraulically under control of the mold cycle timer. Wet molded pieces are unloaded manually onto dryer cars, dried at 400 deg. F., then unloaded and end-trimmed. If for pipe covering, they are also split and jacketed in canvas, and the jacketing paste dried. Block insulation requires only end-trimming. The finished product is packed in cartons, stored, and shipped.

An article in an early issue will describe the control features of this process.

for outstanding service

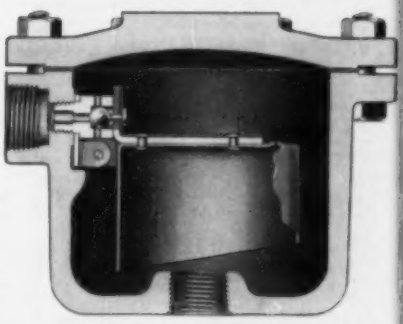
on Heavy-Duty Steam Drying Units

...for example



The installation—
American Linen Supply Co.
Cincinnati

Rely on Dependable CRANE STEAM TRAPS



Crane Inverted Open Float Steam Trap with patented ball-type disc, for 1 to 300 pounds saturated steam working pressures. Literature on request from your Crane Branch or Crane Wholesaler.

PROBLEM: To equip a steam-heated tumbler-type drier with a trap that would reduce start-up time to a minimum, and provide, automatically, a smooth, steady flow of hot, dry steam to the unit, with the lowest possible maintenance cost.

WORKING CONDITIONS: Steam pressure to drier, 125 pounds. Drier operated 16 hours daily on continuous batch basis.

SOLUTION TO PROBLEM: Crane No. 981, ¾-inch, 150-Pound Inverted Open Float Trap, carefully selected for adequate drainage capacity, and properly installed. (Now listed as No. 9810, with patented improved ball-type disc.)

RESULTS: Never requiring any repairs or new parts in more than 8 years' service, this Crane trap has given complete satisfaction. Periodic routine inspection only is total maintenance cost.

...ANOTHER TYPICAL CASE HISTORY demonstrating the better performance... the lower ultimate cost of Crane Valves of all types... and why—
More Crane Valves are used than any other make!

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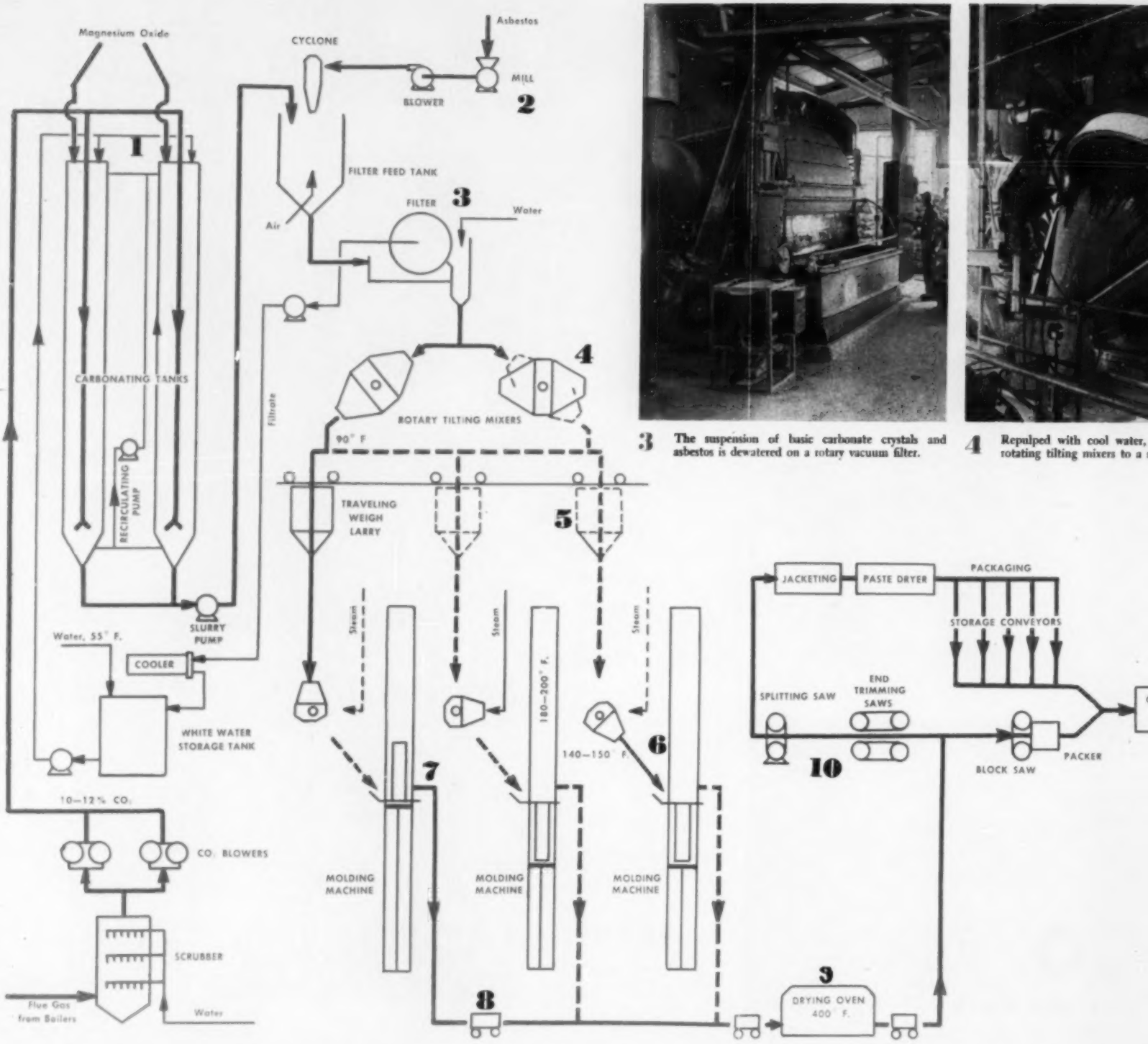
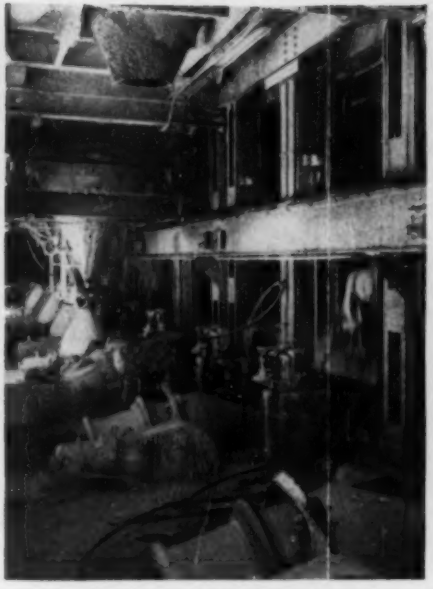


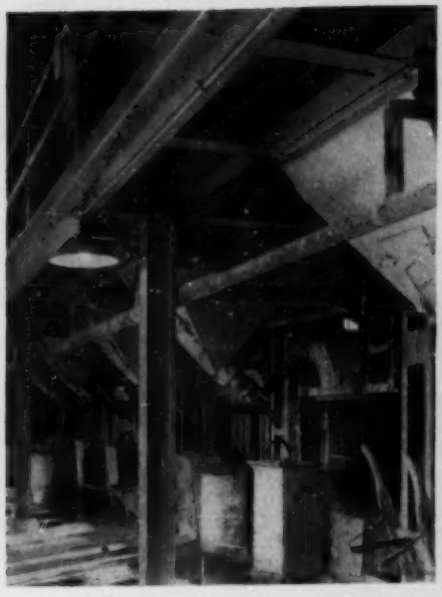
3 The suspension of basic carbonate crystals and asbestos is dewatered on a rotary vacuum filter.

4 Repulped with cool water, rotating tilting mixers to a

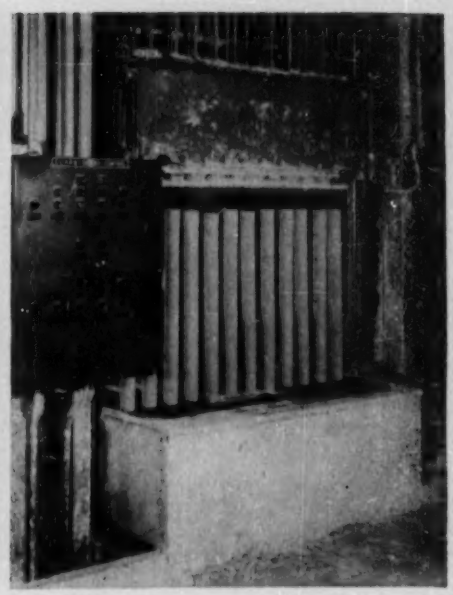
vater, the slurry is mixed in to a suitable density.



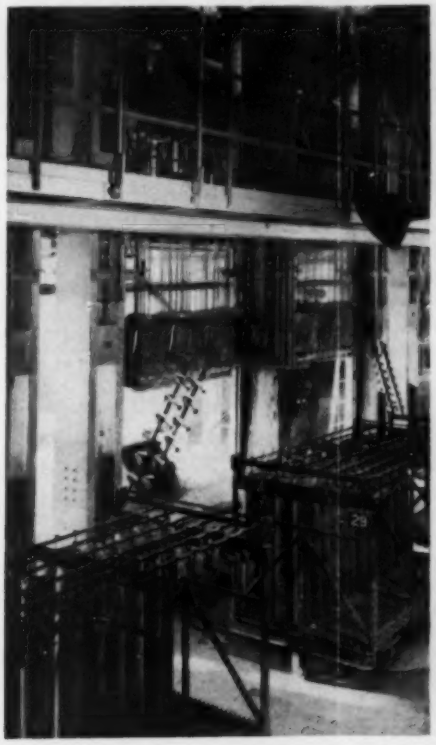
5 The automatic weigh larry at the left carries the slurry from the mixers to the line of preheaters.



6 Mold hoppers, shown elevated, are lowered to receive the slurry from preheaters on the balcony.



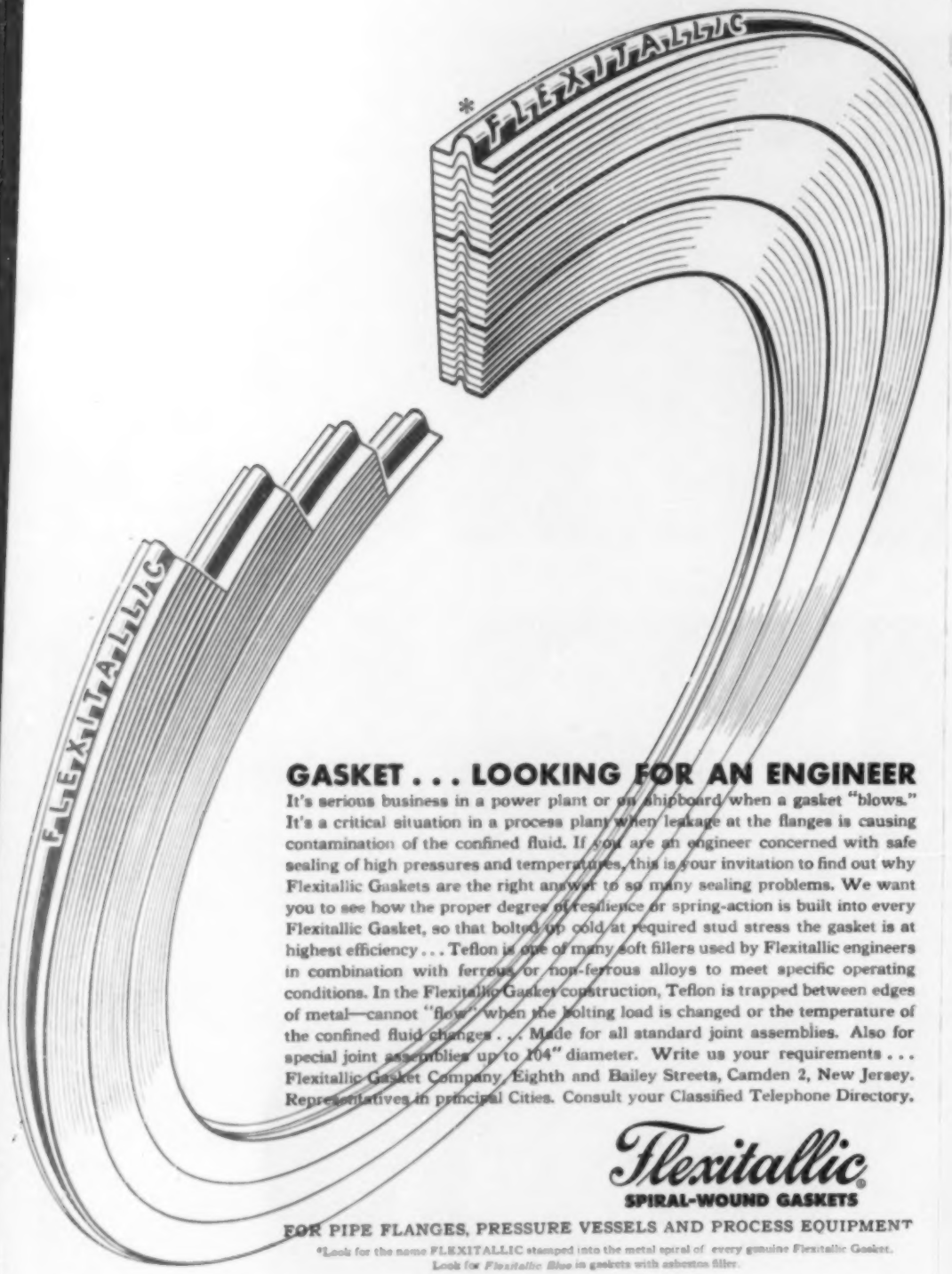
7 Molded cylinders of insulation have just been ejected from the molds under control of a timer.



8 After ejection from molds, the product is lifted manually onto cars for transfer to the dryers.

9 The product is pushed into the dryers a car at a time, where water equal to about 85 percent of the wet weight is removed at 400 deg. F. Temperature control is obtained by recirculating fans.

10 For pipe covering the finishing operations include end-trimming and splitting, covering and drying the cover, and packing. Insulating block is end-trimmed but does not require addition of a cover.



GASKET . . . LOOKING FOR AN ENGINEER

It's serious business in a power plant or on shipboard when a gasket "blows." It's a critical situation in a process plant when leakage at the flanges is causing contamination of the confined fluid. If you are an engineer concerned with safe sealing of high pressures and temperatures, this is your invitation to find out why Flexitallic Gaskets are the right answer to so many sealing problems. We want you to see how the proper degree of resilience or spring-action is built into every Flexitallic Gasket, so that bolted up cold at required stud stress the gasket is at highest efficiency . . . Teflon is one of many soft fillers used by Flexitallic engineers in combination with ferrous or non-ferrous alloys to meet specific operating conditions. In the Flexitallic Gasket construction, Teflon is trapped between edges of metal—cannot "flow" when the bolting load is changed or the temperature of the confined fluid changes . . . Made for all standard joint assemblies. Also for special joint assemblies up to 104" diameter. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey. Representatives in principal Cities. Consult your Classified Telephone Directory.

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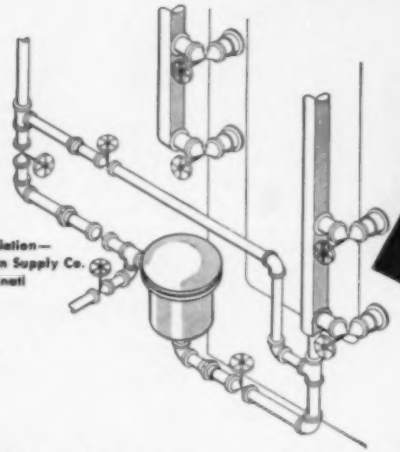

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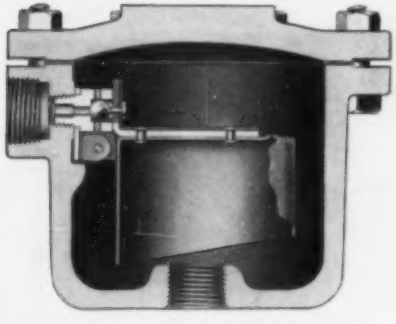
Rely on Dependable CRANE STEAM TRAPS



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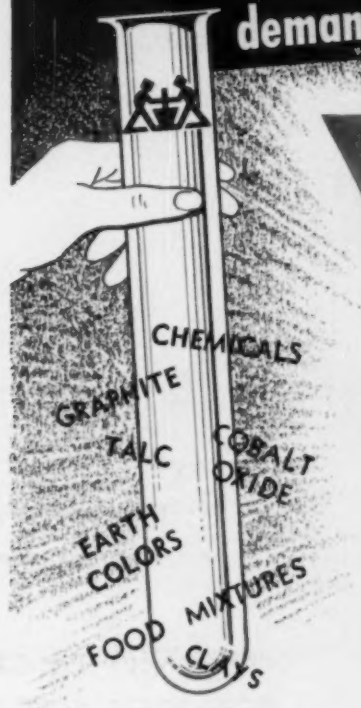

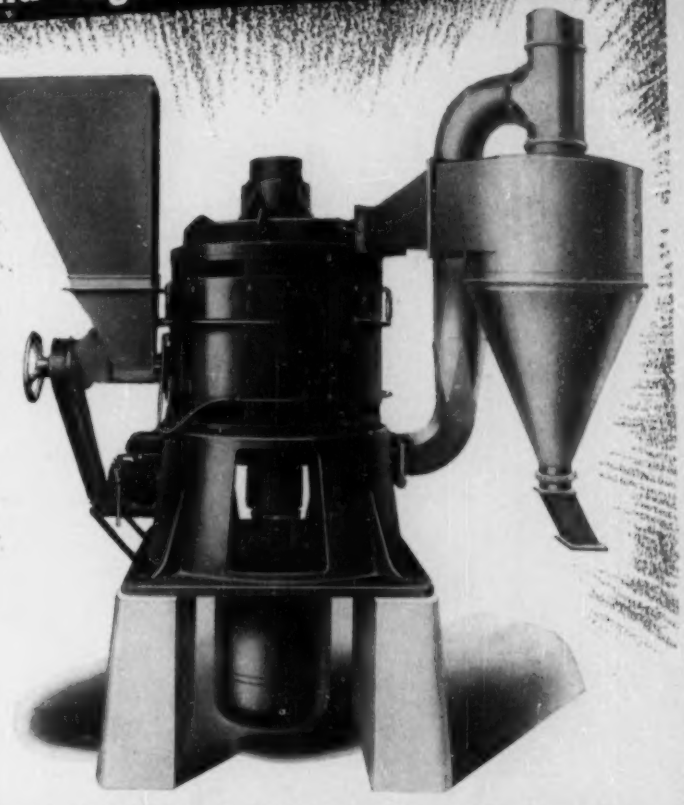

Raymond VERTICAL MILL may be the Answer

Here is a modern pulverizing unit specially designed for production of uniform powdered materials in the sub-sieve sizes. It operates in a fineness range well beyond ordinary mills.

This Mill is intended for softer materials which are not highly abrasive and Raymond Whizzer Separation provides unusually close product control in the extreme fineness range. Many materials can be consistently made at 95% to 99% finer than 10 to 15 microns, while some materials can be reduced to as fine as 95% to 99% passing 5 to 10 microns.

The VERTICAL MILL is only one type of unit in Raymond's comprehensive line of fine grinding equipment. If you have an operation involving fine grinding tell us about it in detail and let us recommend a suitable unit specifically tailored for your job.

For detailed information on the Vertical Mill, write for Bulletin No. 57

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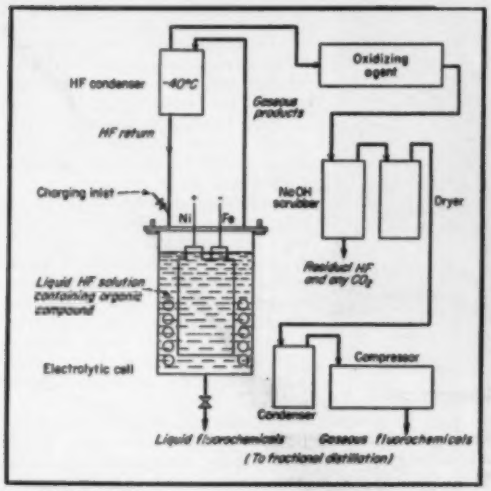
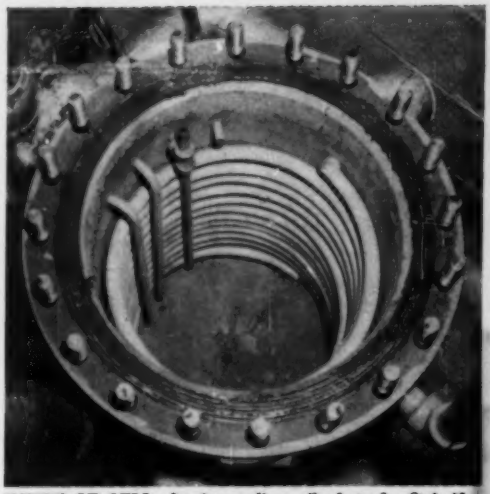


FLUORINATION of organics takes place in Simons cell.



INSIDE OF CELL, showing cooling coil; electrodes fit inside.

Fluorochemicals Go Commercial

Electrochemical fluorination, a new unit process, paves way for their production by 3M. No fluorine is used in direct single-step Simons process.

A new electrochemical fluorination process is fast opening up the exciting new domain of the fluorochemicals. In a new $250,000 plant at Hastings, Minn., first of its kind, Minnesota Mining & Manufacturing Co. is now turning out 250 lb. a day of fluorochemicals. And that's only the beginning. Electrochemical fluorination, developed by Dr. Joseph H. Simons of the University of Florida, is more than just another method for producing one kind of compound from a particular starting material. It's a basically new unit process.

The Simons process consists of passing a current through a mixture of the organic starting material and liquid anhydrous hydrogen fluoride in an electrolytic cell. Hydrogen comes off at the cathode. The fluorochemical discharges at the anode as a gas or liquid, and is purified by distillation.

Advantages: To the tail of the high flying Simons process kite is tied this string of advantages:

▶ It sidesteps fluorine, uses instead liquid anhydrous hydrogen fluoride. Elemental fluorine is nasty and dangerous to work with. Since none is used or produced in the process, it's much safer than earlier processes. And there's no chance of free fluorine decomposing the organic compound in the cell.

▶ Anhydrous HF is non-corrosive, so ordinary materials of construction can be used for process equipment.

▶ No diaphragms are required in the cell as the hydrogen evolved doesn't react with any of the fluorochemicals produced. Hence many electrodes can be fitted inside a single cell.

▶ Compactness of a cell per unit of power makes for high volume efficiency.

▶ It's a highly flexible process. Almost all organic compounds, even those not directly soluble in liquid HF, can be used as raw materials, and with only slight changes in operating conditions the process can produce a wide variety of fluorine-containing compounds, many of them never before made by any other process.

▶ The process makes possible production of fluorochemicals of predetermined fluorine content. Thus products with specific physical and chemical properties can be custom-tailored to industrial requirements.

▶ It's a straightforward single-step process. The hydrogen fluoride reacts directly with the organic compound in the electrolytic cell.

▶ Best and most important of all, it's a potentially low-cost process. "We are aiming," says Dr. Nelson W. Taylor, manager of 3M's fluorochemicals department, "at eventual selling prices which will encourage wide usage by industry."

Cell Construction: The cell that Minnesota Mining uses in its current semi-commercial operation at Hastings is a cylindrical steel vessel 6 ft. high and 4 ft. in diameter. It has a cooling coil inside it through which water, brine or alcohol can be circulated. When the cover is bolted on top, the electrode pack, which is suspended from the cover, fits down into the cell. The electrode pack consists of a series of alternate nickel anode and iron cathode plates spaced about a half inch apart. Liquid level in the cell is maintained by electrical probes. The cell is operated at 10,000 amp. d.c. and 5 v., less than required to decompose HF. Theoretically, it takes only 3 v. to generate free fluorine, but in actual operation the resistance of the electrodes, the electrolyte and the electrode polarization films eats up voltage so that it takes

HOW CELL IS ASSEMBLED: electrode pack fits down into laboratory cell.

up to 10 or 12 v. to liberate fluorine.

Operation: Normally, the cell operates at about 20 deg. C. and atmospheric pressure. Anhydrous liquid HF and the organic raw material are pumped continuously into the cell as products are continuously removed. As the 10,000-amp. current passes between the electrodes, hydrogen evolved at the cathode agitates the liquid. Fluorochemical products are continuously discharged at the anode as gases or liquids. Gaseous fluorochemicals, together with hydrogen and any vaporized HF, leave the cell through an outlet at the top and go to a condenser at about −40 deg. C., where the HF is condensed and returned to the cell. The other constituents are substantially insoluble in the liquid HF condensate and are carried along in the gas stream. Next, hydrogen is separated by passing the stream over heated copper oxide to convert the hydrogen to water vapor. Then residual HF and any CO_2 present are scrubbed out by NaOH, and the fluorochemical products cooled and compressed. Liquid fluorochemical products, more dense than the cell solution, are drawn off from the bottom of the cell. Both gaseous and liquid products are finally purified by fractional distillation.

Gaseous fluorochemicals can also be separated from the hydrogen by condensing and even freezing some of them in a liquid-air condenser at very low temperature, but not low enough to condense the hydrogen. After the hydrogen has passed off, the liquid air can be cut off, the fluorochemicals warm up, vaporize and are recovered.

Flexibility: Operating conditions can be varied over a broad range. Temperatures from −80 up to 80 deg. C. have been used. Pure hydrogen fluoride freezes at −83 deg. C., but slightly lower temperatures are possible when it contains dissolved material. Temperatures from 0 to 20 deg. C. permit operation at about atmospheric pressure (hydrogen fluoride boils at 19.5 deg. C.). Higher temperatures may require greater than atmospheric pressure to raise the boiling point or the dissolving of potassium or sodium fluoride in the solution to lower its vapor pressure. Sometimes, especially with low-boiling organics that are not dissolved in the liquid HF, cell pressure greater than atmospheric is needed to keep the compound in the liquid phase or to prevent rapid evaporation, even though a low operating temperature is employed. Cooling can be effected with water, brine, alcohol or ethylene glycol in aqueous solution.

A host of raw materials, both cyclic and non-cyclic organics, can be used. Among them: hydrocarbons, acids, anhydrides, alcohols, ethers, esters, aldehydes, ketones, nitriles, amines and amides. Even compounds sparingly soluble in HF and that do not form highly conducting solutions can be used by adding a third component, either organic or inorganic, such as acetic acid or potassium fluoride, to increase conductivity. This makes it possible to use very cheap organic compounds, such as the hydrocarbons, to produce fluorochemicals. Use of two or more organic starting materials sometimes improves operating efficiency. For example, the efficiency of the electrolytic fluorination of hexyl ether is improved if carried on in the presence of propionic acid.

Fluorochemical products of almost endless diversity can be made. Some are made directly in the cell, others are their derivatives. Not only the fluorocarbons, which contain only fluorine and carbon and are counterparts of the hydrocarbons, but a raft of other fluorochemicals can be produced. These include fluorinated acids, esters, aldehydes, alcohols, amines and amides.

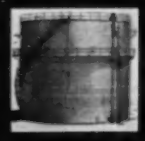
Products: First commercial chemicals to come from Minnesota Mining's new plant will be of two kinds: (1) reactive compounds like trifluoroacetic, heptafluorobutyric, perfluorosuccinic, perfluoroadipic and other completely fluorinated acids and their derivatives; and (2) inert perfluoro gases and liquids like perfluorobutane, perfluorotripropyl amine and perfluorodiethyl ether.

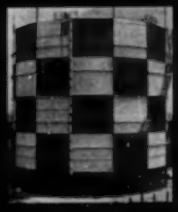
The new fully fluorinated acids can be used to hook fluorocarbon groups into organic compounds, increasing their thermal and chemical stability and fire resistance and lowering their surface tension and refractive index. The inert liquids are significant because of their unusual thermal and chemical stability, dielectric properties, non-corrosiveness and high densities.

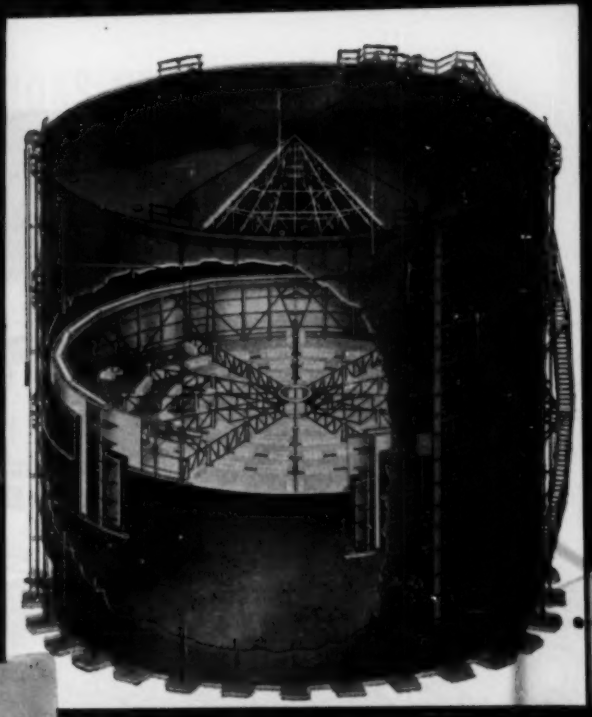
High-boiling fluorocarbons with vapor densities many times that of steam could be used in turbines, reducing their size and increasing their thermodynamic efficiency. Fluorocarbons may play a big part in the future of solvent extraction. And since fluorocarbon lubricants reduce fire hazard and can be used in the presence of such highly oxidizing gases as oxygen and chlorine, multi-stage compressors, with a low compression ratio in each stage to avoid combustion of present hydrocarbon lubricating oil, might be redesigned to work at higher compression ratios and hence with fewer stages.

Among likely commercial fluorochemical products are a cast film that's non-flammable (structurally akin to polyvinyl acetate and made by polymerizing an unsaturated perfluoro acid), light-fast dyes, a fiber made from perfluoroadipic acid, plastics and paints that won't burn or become brittle, a non-toxic fire-extinguishing liquid better than any other known (trifluorobromomethane), pharmaceuticals, surface-active agents, dielectrics, hydraulic fluids and lubricants.

Origin: Simons first got interested in fluorochemicals in the early 1920's while he was working with Professor







safe, simple,

See American Gas Association Builder's Committee Report (May, 1951)

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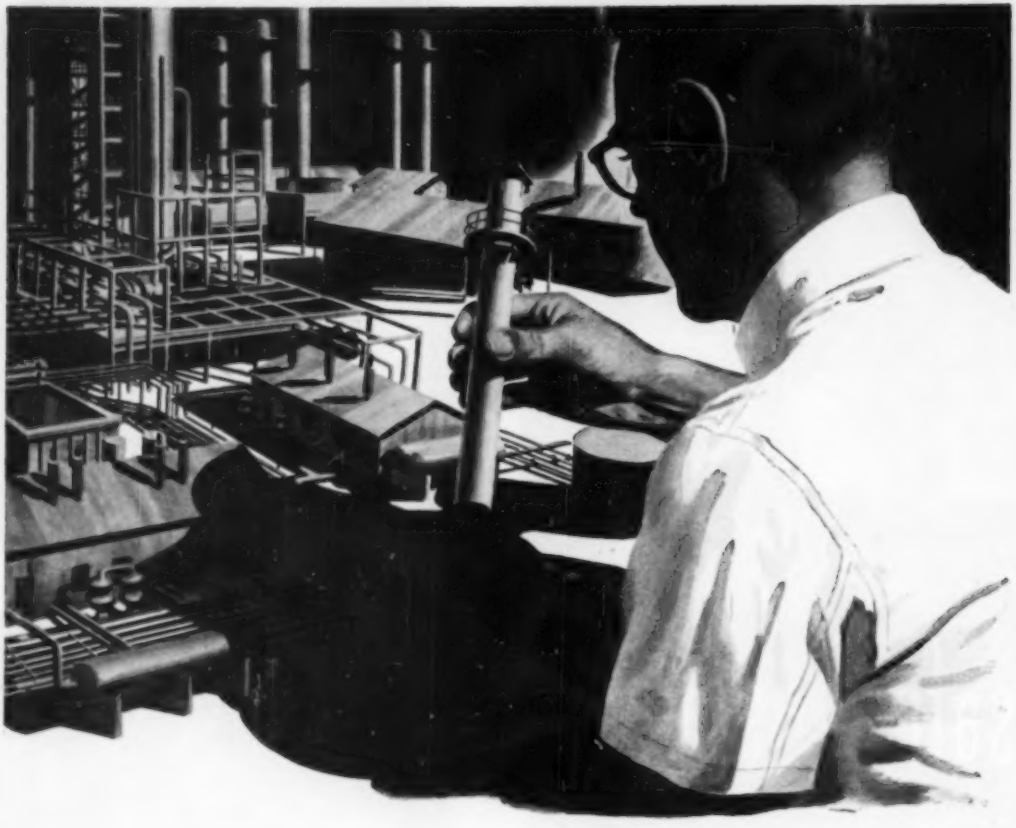

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Inventor Simons: New cell was his idea.

J. H. Hildebrand at the University of California. But it was not until the eve of World War II that he began producing fluorocarbons in the laboratory at Penn State. Known by the code name "Joe's Stuff," they played a big part in the atomic bomb project.

Cost: Right now, the cost of fluorochemicals is pretty steep. Minnesota Mining sells them at prices ranging from $5 to $15 a lb. Trifluoroacetic acid, largest volume product made by 3M, sells for $5 a lb. in carboys; higher acids and some amines and ethers cost from $11 to $15. But as production mounts, prices should eventually drop to $2 or even $1 a lb. for many fluorochemicals.

Up to now, 3M's biggest customers for experimental quantities have been the major chemical, pharmaceutical and electrical companies and such federal agencies as AEC. Liquids are shipped in 80-lb. carboys and gases in cylinders from 1 lb. to 100 lb.

Future: Power is one clue to Minnesota Mining's next move. At present, the company has one cell operating in its semi-commercial plant at Hastings, plans to put up another soon. And it now looks as if a 20,000-amp. current is tops for the Simons cell. As a result, individual cell capacity is limited. Moreover, power costs in the St. Paul area limit the number of cells to about a dozen. So any move away from Hastings, which is on the Mississippi about 18 mi. southeast of the company's St. Paul headquarters, to a spot near a low-cost power area will be the tipoff that the company is going into big volume production. Meantime, Minnesota Mining has staked a claim for itself in chemicals by being first to make fluorochemicals by the Simons electrochemical fluorination process.

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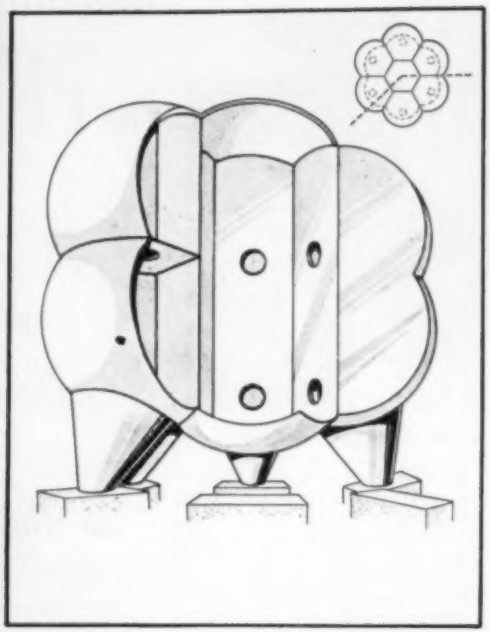


14 Lobes Make a Big Sphere

Dow's new 14-lobe Multisphere is the first pressure vessel of its kind. It stores some 100,000 gal. of liquid methyl chloride at 150 psi.

Multi-lobe pressure vessels—Horton Multispheres—are fast catching on among chemical plants. One new type, a vertical Multisphere, is now being used to store ammonia (*Chem. Eng.*, Nov. 1951, p. 188).

But the latest (and most eye-catching) is the 14-lobe spherical unit recently put up at Dow's plant near Freeport, Tex. (see cut). Dow uses it to store liquid methyl chloride at 150 psi.

It has a capacity of 105,000 gal. of liquefied gas. The cost, with foundations, was close to $80,000. Chicago Bridge & Iron Co. designed and put up the unit.

Unique Features: Dow's Multisphere has 14 part-spheres (six for each of the two layers, one at the top center, one at the bottom center) welded together into a single vessel. Stress components are absorbed by internal diaphragms welded to the shell where lobes meet. Holes in the diaphrams allow the contents to pass freely from one lobe to another.

Some 42 percent of the plates in the steel structure are flat; the remainder are dished. The vessel, designed for a working pressure of 150 psi., was tested hydrostatically at 225 psi. It was built under the latest ASME code for unfired pressure vessels.

Multisphere design makes it possible to use lighter weight plates. The side plates in Dow's unit are 0.62 in. thick; the bottom ones are 0.77 in. A 30-ft. Hortonsphere with the same capacity and working pressure would need shell plates which are about 1.2 in. thick.

In spite of these differences in plate thicknesses, Multispheres would normally require about the same total tonnage of steel as Hortonspheres or Hortonspheroids.

Advantages of Multispheres: A sphere is the best design to withstand pressure. But large single spheres often require thicker steel plates than are practical or allowable under the ASME code for unfired pressure vessels.

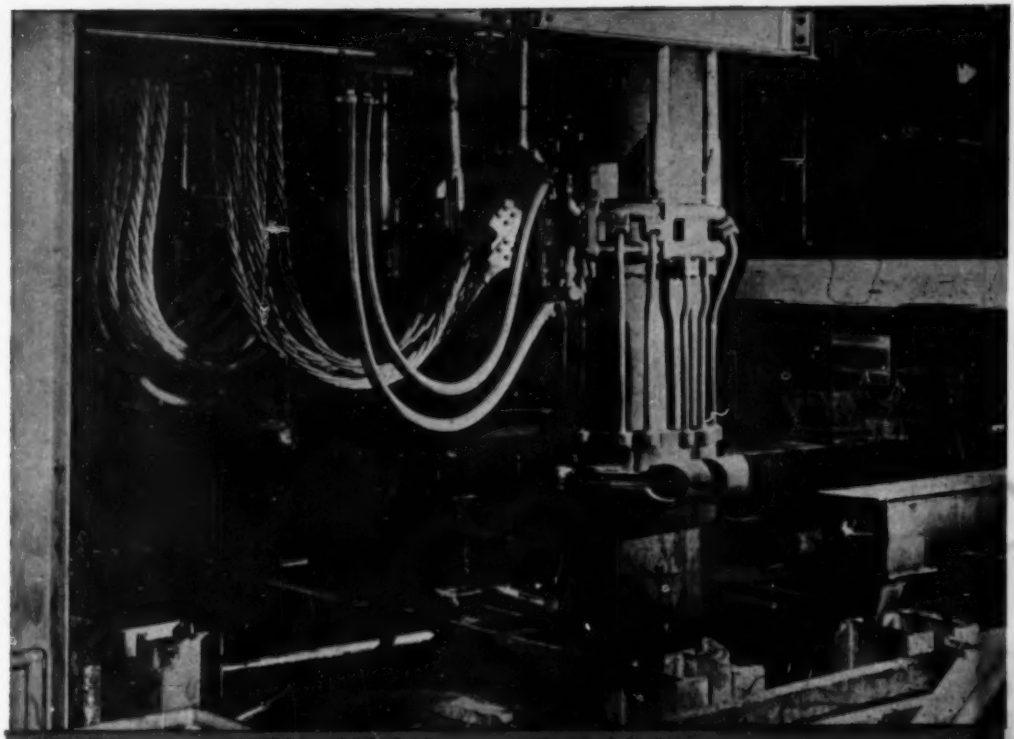
Large single spheres also may put too much of a load on foundations. And often they simply won't fit conveniently into the space that's available.

A number of small single spheres with the capacity of one big one would get around all these difficulties. But they would take up too much room, and have other obvious disadvantages.

The Horton Multisphere design is the answer, say Chicago Bridge's engineers. By welding together a number of small spherical segments they can come up with a vessel of almost any size, shape or capacity that (1) will conform with requirements of the ASME code on plate thicknesses, (2) can be made to fit into almost any space, (3) will not need specially reinforced or expensive foundations, and (4) will usually be in line with the costs of other types of spherical vessels.

Striking feature of the new Multisphere design is the flexible (and odd) shapes that are possible. Dow's unit is spherical; the ammonia unit is tower-like (the so-called "multiple Mae West" type). Others could be horizontal, rectangular or possibly even serpentine.

Yet all these odd shapes and sizes are based on perfectly sound engineering principles. And the chemical industry will welcome the greater flexibility that's now possible in the pressure storage of its products and raw materials.



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Chemical Pipelines Pay Off

Texas network provides fast, low-cost way to move chemicals from one plant to another. And now the lines are carrying hydrocarbons northward.

More and more pipelines to carry chemicals and chemical raw materials are being strung all the time, especially in the Gulf Coast area.

Today about 200 mi. of chemical pipelines are planned or under construction in the Houston-Port Arthur area alone. Chemical pipelines, extending up to 100 mi., crisscross the Texas countryside, particularly around Houston. And now they're snaking northward, carrying hydrocarbon-rich Texas natural gas to new petrochemical plants being built closer to market.

Fanning Out: The line of Tennessee Gas Transmission Co., for example, carries wet gas, containing ethane, propane, butanes, hexanes and heavier hydrocarbons, from Texas to Gabe, Ky., where 16 percent of the ethane and substantially all of the other hydrocarbons except methane are stripped from the gas in the new liquid hydrocarbon recovery plant of Tennessee Gas. At capacity, the plant will process about 750 million cubic feet of natural gas daily, getting about 380,000 gal. of liquid hydrocarbons from it.

This liquid hydrocarbon stream will be piped 58 mi. to the new $17 million plant of Mathieson Hydrocarbon Chemical Corp. at Brandenburg, Ky., where it will be fractionated into ethane, propane, butanes and natural gasoline. Propane and butanes will be sold as bottled gas, while the ethane will be cracked to ethylene for production of ethylene oxide, ethylene glycol and other petrochemicals.

In another such venture, National Petro-Chemical Corp., owned 50 percent by National Distillers and 50 percent by Panhandle Eastern Pipe Line Co., will build a $38 million plant at Tuscola, Ill., to strip hydrocarbons from the 400 million cubic feet of gas that the Panhandle line carries daily and convert them into chemicals. Phillips Petroleum Co. will sell the bottled gas, while National Petro-Chemical will convert the ethylene from ethane into ethyl alcohol and ethyl chloride. National expects the extraction plant to be completed by October 1952 and the entire project to be completed by May 1953. This marks the entry of National Distillers into petrochemicals.

Still another pipeline project, now being carefully sized up, might team Pittsburgh Coke & Chemical Co. with its corporate cousin, Texas Gas Transmission Co., in an undertaking that would see Pittsburgh Coke making petrochemicals from its partner's abundant supplies of natural gas.

Texas Network: Use of pipelines for chemicals comes naturally to Texas, where refiners have used such lines for many years to move vast quantities of oil and gas.

But there's more to it than that; the trend to pipelines is abetted by the character of the chemical industry in Texas.

That industry fulfills the major requirement for the low-cost use of pipelines: it moves chemical raw materials and chemical products in such great volume that it can keep a pipeline between two points filled. It doesn't cost much more to lay and operate a 6-in. line than it does a 1-in. line. But the bigger pipeline will move more than 36 times as much material. Consequently, pipelines are well suited to the big volume opera-

Chemical Pipelines in Texas

Chemical	Route	Length, Mi.	Diameter In.
Acetone	From Shell's Deer Park plant to Rohm & Haas at Deer Park.	3	—
Brine	From Benavides to Corpus Christi plant of Columbia-Southern	63	16
Brine	From Barbers Hill to Diamond's Deer Park plant	17	10
Brine	From Bryan Mound to Dow's Freeport plant	5	—
Brine	Between Dow's plants at Freeport and Velasco	8	10
Brine	From Texas Brine Corp. at Pierce Junction to Champion Paper & Fibre and Ethyl Corp. at Pasadena and to other plants on Houston Ship Channel as far as Deer Park.*	20	8
Butadiene	From Sinclair Rubber at Houston to Goodyear Synthetic Rubber at Houston.	0.25	—
Carbon dioxide	Handles stack gas at Dow's Freeport plant	1	4
Caustic soda	From Diamond at Deer Park to Shell at Deer Park	1	3
Caustic soda	Between Dow's Freeport and Velasco plants	8	8
Chlorine (gaseous)	Three lines between Dow's Freeport and Velasco plants	8	6, 10, 14
Chlorine (liquid)	From Diamond's Deer Park plant to Shell at Deer Park	1	3
Ethylene	From Humble's refinery at Baytown to Carbide's Texas City plant.	35	4
Ethylene	Between Dow's Freeport and Velasco plants	8	4
Ethylene	From Gulf's Port Arthur refinery to Ethyl Corp. and Shell at Deer Park.*	76	8
Ethylene	An extension of the above to serve Monsanto, Carbide and others at Texas City.*	40	6
Ethylene	From Gulf's Port Arthur refinery to Du Pont at Orange	32	6
Ethylene	From Gulf's Port Arthur refinery to Koppers.*	2	—
Ethylene	From Monsanto at Texas City to Carbide at Texas City	1	—
Ethylene	From Shell at Deer Park to Diamond at Deer Park	1	—
Hydrogen	From Diamond's Deer Park plant to Ethyl Corp. at Deer Park.*	2	—
Hydrogen	Between Dow's Freeport and Velasco plants	8	—
Hydrogen chloride	From Diamond's Deer Park plant to Rohm & Haas at Deer Park.*	1	—
Hydrogen chloride	From Diamond at Deer Park to Shell at Deer Park.*	2	—
LPG	Between Dow's Freeport and Velasco plants	8	10
LPG and ethylene	From Carbide and Monsanto at Texas City to Dow's Freeport plant.	42	4
Milk of lime	Between Dow's Freeport and Velasco plants	8	8
Oxygen	Pipeline network radiating from Houston Oxygen Co. for distances up to 10 or 12 mi. to metal fabricating plants and other consumers in area.*	—	3
Propane	From Warren Petroleum on Houston Ship Channel to Dow at Freeport.	77	—
Propane	From J. S. Abercrombie Co. at Sweeney to Dow's Freeport plant.	40	—
Propane	From Humble Oil at Katy to Dow at Freeport	85	—
Propane	From Pan-American Refining at Texas City to Monsanto at Texas City	2	—
Propane	From Republic Oil at Texas City to Monsanto at Texas City	0.25	—
Propane	From Warren Petroleum at Lake Creek to Warren's terminal on Houston Ship Channel.	—	—
Propane	From Warren Petroleum on Houston Ship Channel to Texas City Terminal (leased to Pan-American Petroleum).	35	—
Propylene	Between Dow's Freeport and Velasco plants	8	4
Refinery gases	From Texas Co.'s Port Arthur refinery to Jefferson's Port Neches plant.	5	6-8
Refinery gases	From Pan-American Refining at Texas City to Carbide at Texas City	0.25	—
Styrene	Between Dow's Freeport and Velasco plants	8	4

* Under construction or planned.

tions of the Gulf Coast chemical industry.

Products carried by the network of pipelines in Texas range from such raw materials as brine and propane to such finished products as acetone and styrene.

What's Carried: One of the first raw materials to be carried by pipeline was brine. Both Columbia-Southern Chemical Corp. at Corpus Christi and Diamond Alkali Co. at its Deer Park plant near Houston bring brine to their plants in cast iron pipes. Now Texas Brine Corp. has started construction of a 20-mi. transite line from Pierce Junction to deliver brine to Champion Paper & Fibre Co. and Ethyl Corp. at Pasadena and to other plants on the Houston Ship Channel as far as Deer Park. A combined total of 113 mi. of brine lines are in operation or being built.

When Gulf Oil Corp. completes the network of over 150 mi. of pipelines it is now constructing to distribute ethylene, the total length of ethylene pipelines will be increased to 250 mi. From Gulf's Port Arthur refinery the lines will run northeast to Du Pont's plant at Orange and southwest to Ethyl Corp. and Shell at Deer Park, and also to Monsanto, Carbide and others at Texas City.

One old timer among Texas pipelines, the 42-mi. line between Texas City and Freeport, is no longer in operation. It was built about 1942 to carry liquefied petroleum gases from Texas City to Dow's Freeport plant. During World War II it carried ethylene, but now it is out of service. And a pipeline out of a job can't just be torn from the ground and transplanted.

Dow uses 10 separate lines to move eight different materials the 8 mi. between its Freeport and Velasco plants. Materials transported: brine, gaseous chlorine, LPG, ethylene, propylene, milk of lime, hydrogen and styrene.

Outlook: Chemicals will be moved in pipelines in ever increasing volume, and more lines will be built wherever they can be kept filled between two points. They're spoking north from Texas into the Southeast, the Midwest and even, though to a lesser degree, into the densely populated East. But it's unlikely that any other area will overtake Texas, with its long lead in pipelines.

As more Texas natural gas, rich in hydrocarbon raw materials, is brought to other parts of the country by pipelines, new petrochemical plants to use the Texas gas will spring up closer to market.

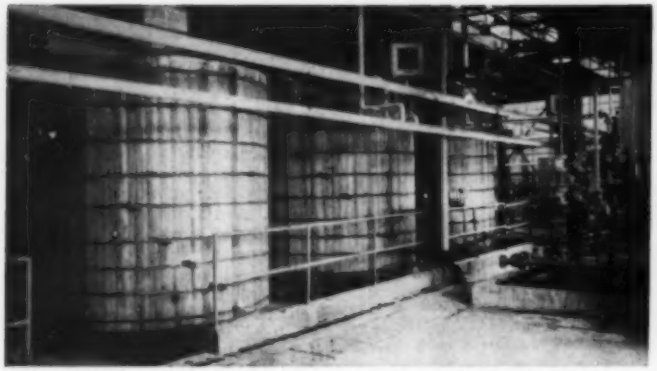
Phosphate Reserves Bought By International Minerals

With things as they are, the directors of Hoover & Mason Phosphate Co. felt it unwise to lay out a large investment. Phosphate deposits were exhausted in their Mt. Pleasant, Tenn., area. And it would take a good chunk of capital to build a plant near the reserves in Rutherford Creek. So stockholders decided to sell.

Late in October a deal was made with International Minerals & Chemical Corp. A contract has been authorized for the acquisition of Hoover & Mason's outstanding capital stock by IMC. The acquisition will be made through an exchange: 40,000 IMC common shares for the Hoover & Mason stock.

This month Hoover & Mason is finishing up its operating agreements with other companies. As soon as they are terminated, all physical assets will be turned over to IMC.

Under the transaction, IMC will acquire around $800,000 in current assets and about 2,500 acres of phosphate mining property, principally in area of Rutherford Creek, Tenn.



PRECIPITATION of silica hydrogel gives vast surface area to the product.

WASHING gives high-purity product.

Silica Hydrogel Is the Key

Cyanamid's streamlined new plant turns out microspheroidal cracking catalyst by the ton. Process and product both hinge on precipitating a latticed silica hydrogel.

This year, for the first time, catalytic cracking outstripped thermal cracking as a source of gasoline. And this year, for the first time, the output of catalysts for petroleum cracking topped $30 million.

The recent start-up of American Cyanamid's brand new plant in Michigan City, Ind., highlights two related trends in petroleum refining:

- A swing toward fluid catalytic cracking;
- The rapid rise of synthetic microspheroidal catalysts for this purpose.

Behind this trend to microspheroidal catalysts lies the structure of the material itself—the vast network of activated silica-alumina pores that gives each pound a surface area of some 55 acres. And the key to this labyrinthine structure is the heart of the manufacturing process: the formation of silica hydrogel.

Cyanamid's Role: Cyanamid's new $3 million plant at Michigan City, now on stream, will ultimately be expanded. It can then turn out enough catalyst for the fluid cracking of 400,000 bbl. a day of petroleum products.

In addition, Cyanamid has recently expanded its Fort Worth, Tex., plant; this unit has been making synthetic silica-alumina cracking catalyst since 1943. And it was here that the microspheroidal synthetic (MS) type of catalyst was first produced in 1946.

With its expanded capacity at Fort Worth and the planned expansion at Michigan City, Cyanamid's output will then be sufficient for a fluid cracking capacity of 1,000,000 bbl. per day.

Cyanamid's experience with silica-alumina catalyst began in 1942 when the government asked it to prepare and manufacture such a material. Process development and plant construction went forward simultaneously. When operations began at Fort Worth, Cyanamid was turning out one third of the fluid catalyst used in the World War II high-octane aviation fuel program. Later, the company became the first commercial producer of the microspheroidal catalyst.

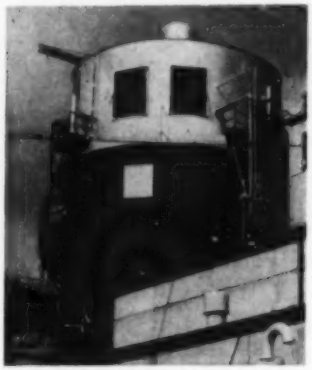
Process in Brief: The method of making synthetic silica-alumina microspheroidal catalyst at Michigan City requires five basic raw materials: sodium silicate, aluminum trihydrate, sulphuric acid, demineralized water and anhydrous ammonia.

Each ton of finished product requires 15,000 gal. of high-purity water, says Read Larson of the firm's petroleum chemicals staff.

Basically, the continuous process consists of precipitating alumina on a silica gel purifying and drying.

An unusual system to make aluminum trihydrate solution was developed, Larson says. It is completely enclosed all the way from the hopper car to the dilute solution tank. From the hopper car it is air conveyed to the storage silo; it then drops through a weigh hopper to the brick-lined digestor where it is treated with sulphuric acid and diluted. It is then settled and pumped to the process.

Precipitation: Real beginning—and heart—of the process is forming the silica hydrogel from sodium silicate. Here the complex chemistry calls for close control of all variables. A battery of wooden tanks (see cut) are used for hydrogel precipitation.



SPRAY DRYING gives microspheres.

The hydrogel at this point is a lattice system of alternate silicon and oxygen molecules with hydrogen and random sodium atoms attached to the silicon. Interstices of the lattice-work form pockets filled with water.

Next step is to add aluminum trihydrate solution to the finished gel; this precipitates an alumina gel within the silica grains. When the combined gel is dehydrated, the result is an enormous surface area dotted with active alumina centers.

Filtration: The next step—filtering and washing—frees the silica-alumina gel slurry from soluble salts.

Giant rotary vacuum-type continuous filters are used: they are believed to be the world's largest. Cyanamid engineers pioneered the use of rotary vacuum filters for gel washing.

After this multiple washing, the

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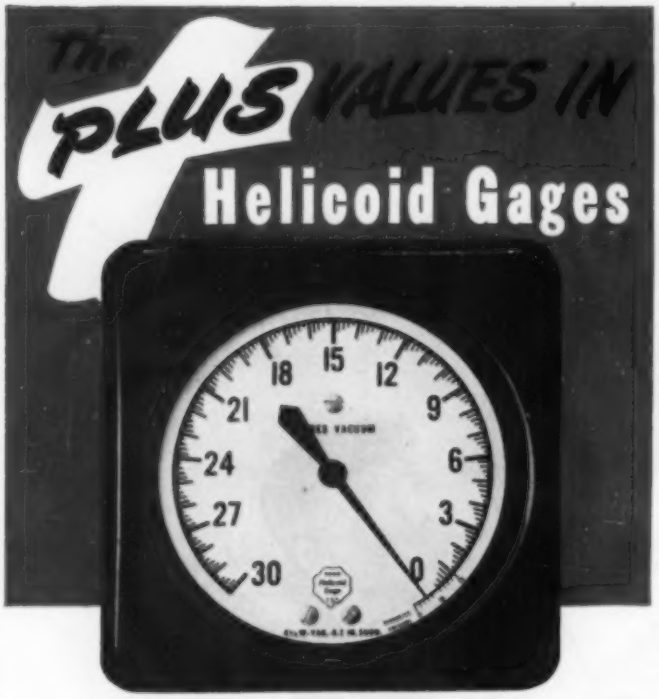

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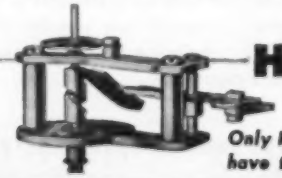

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Only Helicoid Pressure Gages have the Helicoid Movement

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slurry is sent to the spray dryer. The Michigan City spray dryer and its sister at Fort Worth are the two largest in the industry, Larson states.

Spray Drying: The slurry is atomized into a cylindrical chamber where it meets hot combustion gases from the burner; the result is minute round droplets or microspheres. The product is separated from the gas by banks of conical cyclone separators.

Gas leaves the top of the cyclone and goes to the cyclonic scrubber, making the recovery system highly efficient.

Discharge legs of the cyclones empty into a common hopper from which the dried product is air-conveyed directly to storage or is classified by size.

A waste heat recovery tower between the spray dryer scrubber and the stack pre-heats city water before it is demineralized.

One unusual aspect of the process is that everything is enclosed from the introduction of the raw materials to the emergence of the finished catalyst in the storage silos.

Product's Properties: Each microsphere of dried catalyst consists of a silica network with active alumina centers dispersed on a tremendous surface area. Average particle size of the fine grade is about 40 microns, that of the coarser type about 60 microns. The fine grade is for fluid crackers with electrostatic precipitators; the coarser is for units with no secondary recovery facilities.

The product's thermal stability and ability to withstand steaming are important, since the cracking temperature is usually 850-1,000 deg. F. and the catalyst regeneration temperature may reach 1,200 deg.

With an average residence time in the cracker of 150 days and with normal circulation rates, the catalyst will make some 1,400 contacts during its normal life.

Cyanamid's microspheroidal catalyst is designed to give high yields of products for aviation gasoline or petrochemical intermediates. The controlled particle size cuts down catalyst losses in the refinery recovery system. Other advantages of the microspheroidal structure: better fluidization, less erosion of equipment.

New Spectrophotometer Will Perform Three Operations

A triple-threat electronic analyzer, developed by the University of California (Los Angeles) department of chemistry, can analyze unknown solutions, determine purity of substances

in solution, and separate out pure fractions.

Designed and built by Alfred Deutsch, PhD candidate, the continuous flow recording ultraviolet spectrophotometer—which can analyze and separate all substances capable of absorbing ultraviolet light—will most likely become a prime research tool. Using its speed and accuracy, work can be done efficiently and automatically in a fraction of the time required by long and tedious ordinary methods.

The theory and operation of the new spectrophotometer is simple and straightforward. Briefly, the solution first passes through a resin chromatographic column. A dilute selective-solvent wash then carries the absorbed ions through a modified Beckman spectrophotometer. Here the percentage transmission and volume throughout are recorded.

A switch on the recorder actuates electrically operated valves: Fractions corresponding to each complete optical density are thereby collected. If the operator so desires, either the analysis or separation stage may be bypassed.

After effective methods are worked out, the machine will be applied to long-standing biological problems. For example, it will be able to supply accurate data on the occurrence of nucleic substances in both normal and pathological cells and thus help in the study of cancer. Another application will be in the study of genes and chromosomes.

With separation capacity limited only by the size of its chromatographic column, it should find wide applications in industrial and research laboratories throughout the country. Quantity production would lower the cost, now estimated roughly at about $10,000.

CONVENTION CALENDAR

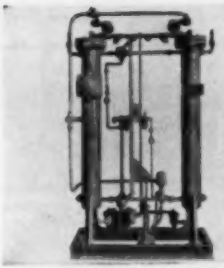
American Chemical Society, Division of Industrial and Engineering Chemistry, symposium on nucleation, Northwestern University, Evanston, Ill., December 27-28.

Society of Plastics Engineers, national technical conference, Edgewater Beach Hotel, Chicago, January 16-18.

Association of American Soap and Glycerine Producers, annual convention, Waldorf-Astoria Hotel, New York, January 22-23.

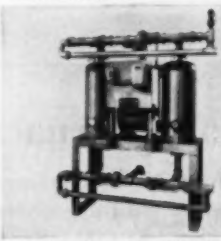
American Pharmaceutical Manufacturers Association, eastern scientific section, Roosevelt Hotel, New York, January 29.

Commercial Chemical Development Association, annual open meeting, Statler Hotel, New York, March 20.

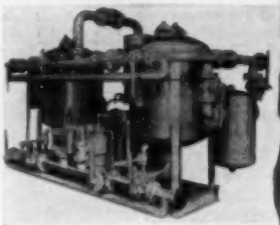


This Kemp Oriad Dryer is controlled by program timer. All operations, including tower reversals, fully automatic. Rated: 100 scfm, 100 psig, 70°F.

This Semi-automatic Kemp Oriad Dryer dries air for actuating tools, valves, etc.—dries process air and gases. Rated: 600 scfm, 100 psig, 70°F.



This Kemp Radiation-Cooled Dryer gives maximum efficiency with minimum maintenance and operating costs. Heating period terminates automatically. Rated: 300 scfm, 100 psig, 70°F.



This electrically activated Kemp Dryer is designed so gas stream is not contaminated by air normally used for reactivation. Rated: 3300 scfm, 100 psig, 70°F.

Cuts Costs on Moisture Control!

Kemp Dynamic Dryers dry Air, CO2, Ammonia, Gasoline, Nitrogen, Propane to low dew points for as little as ¼¢ per mcf

If you think drying air, gases or liquids costs too much—find out how Kemp can save you money! Hundreds of Kemp Dynamic Dryers *control moisture at low cost* in plants all over the country. Operation is guaranteed to your specifications and the cost is surprisingly low. Many Kemp users report drying to *sub-zero* dew points for as little as ¼¢ *per mcf*—including all charges for labor, capital investment and materials!

Flexible Design

Kemp Dynamic Dryers are versatile—offer *manual, semi-automatic* or *automatic* operation. Desiccant is especially selected and compounded for the type drying your problem calls for. With Kemp you can dry *air, gases,* or *liquids, control humidity* in large or small areas, *or eliminate moisture* in materials. Gas, electric or steam regeneration is supplied as standard equipment.

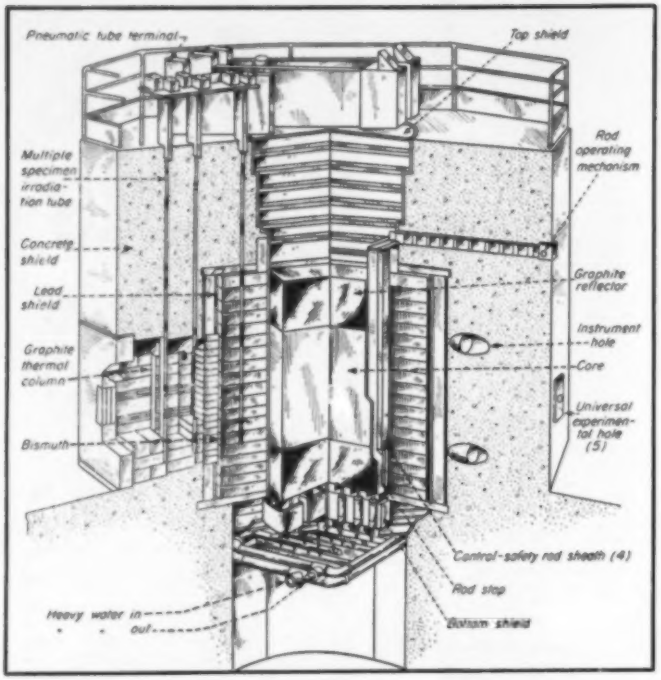
Send for Information

Whether your moisture control problem is standard or special, you'll find Kemp has a Dynamic Dryer especially designed to solve it. Find out how Kemp engineering can be put to work for you to solve your problem . . . save you money. Write today and tell us your requirements. There's no obligation.

KEMP OF BALTIMORE

DYNAMIC DRYERS

WRITE FOR Bulletin D-27 for technical information,
C. M. KEMP MFG. COMPANY,
405 E. Oliver St., Baltimore 2, Maryland.



Now a Low-Cost Atomic Furnace

Private industry may soon have its own research reactor. North American Aviation has designed a practical, low-power, multi-purpose unit. Cost: about $1,000,000.

For the first time, private industry and research institutions can now look forward to operating their own nuclear reactor*:

"The North American research reactor meets the need for a safe, low-cost multi-purpose atomic furnace as trouble-free in operation as possible—and it has a sure place in the spreading development of nuclear technology."

This is emphasized by Dr. Chauncey Starr, who is director of the atomic energy research department of North American Aviation, Inc., at Downey, Calif. Dr. Starr's group designed the unit for AEC's reactor development division.

Design of the low-energy research reactor has been completed, Starr says; the development and testing of its components are slated to be finished by July, 1952. But it would take another 17 months to build it and about six months to test and start it up.

This means that the first reactor, if authorized soon, could probably swing into full operation by mid-1954. Whether or not a unit will be built soon depends on the interest of industry and research organizations. AEC would like to see it.

Research Tool: NAA's reactor will be strictly a research tool. But it's a tool that can run for ten years on a single charge of enriched uranium.

"A low-power reactor of this type would be especially useful in the West," Starr points out. "There is a great deal of important research which could be done on the West Coast if short-lived isotopes—tagged atoms—could be obtained."

These isotopes must now be shipped from AEC's facilities in Tennessee or New York. Many of the short-lived ones (sodium-24 has a half-life of 14.7 hr.) are almost worthless by the time they reach the Coast.

But making isotopes would take only a small fraction of the reactor's capacity. Most of it could be used for experimental work that uses the neutron flow in the pile or in which a neutron beam is led through a port in the shield to irradiate objects outside.

Operating at an energy level of 160 kw., the reactor will give a flow of 6,000 billion neutrons per sq. in. These will be available at over a dozen exposure holes around the reactor core. Thus experimental conditions can be arranged in many ways without changing the reactor's basic design.

One important use of the NAA unit would be for further work on reactor development. It could also be used to train engineers and scientists in reactor operations.

It is not intended as a "power reactor" to generate electrical energy. For that purpose it would have to operate at about 1,000 times its present design.

Cost: For the reactor itself, this is estimated at about $1,000,000. Total construction costs of buildings and complete research facilities would be close to $1,500,000.

A room with 4,000 sq. ft. of working floor space around the reactor, together with a control room, could be built for about $400,000. The reactor itself is octagonal and stands 11 ft. high and 19 ft. wide. It weighs about 450 tons.

A complete 40,000 sq. ft. research setup, including physics, chemistry, biology and engineering laboratories for about 50 people, would cost close to $1,500,000. There is no need for special building construction or shielding.

The only auxiliary equipment that the reactor requires is a standard cooling tower and a standard heat exchanger.

Design Features: NAA's reactor is designed to operate at a heat energy output equivalent to 160 kw.; maximum is 200 kw. At its design output of 160 kw., the unit can operate eight hours a day, five days a week, for ten years on a single charge of enriched uranium.

Thus only once every ten years would the highly radioactive spent fuel be discharged. Then it could be slipped into a thick-walled container and shipped to a reprocessing site.

Core of the reactor is a hexagonal prism 4.5 ft. by 4.5 ft. high. It consists of enriched uranium sealed in an air-tight aluminum tank. This is surrounded by some 34 tons of reflector graphite 30 in. thick.

On the top and bottom of the reflector and on six of the octagonal sides is a shield to protect operating

* In addition to the small 10-kw. research unit now being put up at North Carolina State College.

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The greater uniformity of Mt. Vernon Extra means more efficient filtering – greater clarification of filtrates, more complete recovery of solids.

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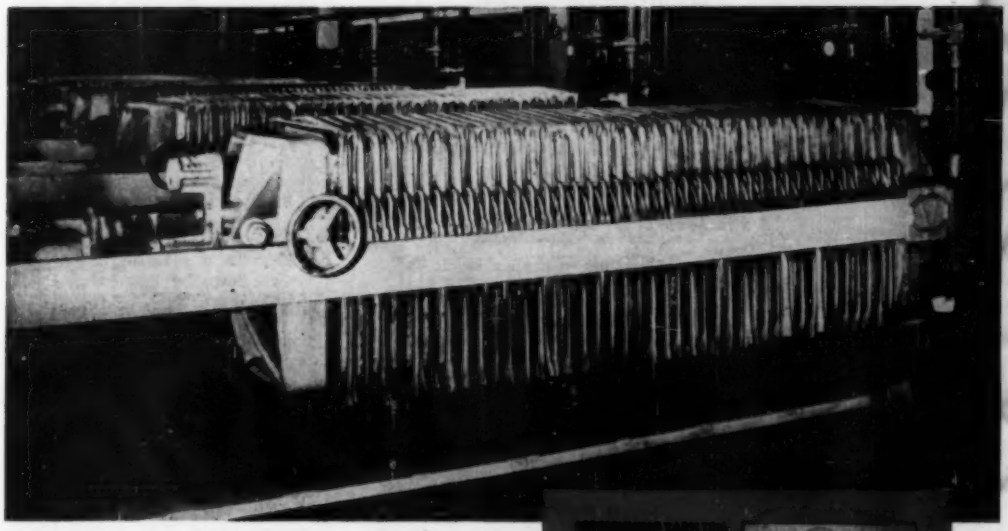

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85% MAGNESIA HEAT INSULATION

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Modern engineering demands precise standards of heat insulation performance. Pabco *Precision Molded* 85% Magnesia combines the time-tested superiority of Magnesia with precision molding to give you a light weight insulation manufactured to very close tolerances.

Simpler and easier to apply! Easier to lift, cut and score. Simpler to imbed tie wires flush in the surface, too!

LIGHT WEIGHT

Pabco *Precision Molded* 85% Magnesia weighs just 11 lbs. per cubic foot. In addition to its light weight, it also brings many timely advantages, including easy application and greater rind strength.

CLOSE TOLERANCES

Pabco's plus tolerance is only ½ *lb. per cubic foot!* This means an amazing degree of control over such factors as Weight and Thermal conductivity. Other controlled factors include size, thickness and uniform fibre distribution.

Precision pipe fit! Both pipe coverings and blocks are molded to exact final size and thickness, not molded oversize and then "milled" to size.

THE DEPENDABLE STANDARD — "MODERNIZED"

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personnel from radiation. This shield is made of 6 in. of steel and about 3 ft. of heavy concrete.

On the other two reactor faces, the reflector graphite continues beyond a bismuth shield that stops gamma rays but not neutrons. A removable cadmium and lead shield at these faces gives access to thermal or "slow" neutrons diffusing through this "thermal column." The shield at the top of the core is removable so that the core can be taken in and out by an overhead crane.

Experimental holes include one that is 6 in. and 15 that are 2 in. in diameter. The design may include up to six vertical pneumatic tubes in the reflector and up to six multiple-specimen irradiation tubes (each to hold about 35 samples).

NAA's reactor is cooled with heavy water in a closed circuit that, in turn, is cooled with light water. Heavy water is used as the primary coolant since its deuterium absorbs fewer neutrons than the hydrogen of ordinary water.

The reactor operator sits at a console desk in the control room overlooking the main floor; he can see all experiments under way.

He can hold the reactor power within design limits by moving the neutron-absorbing cadmium control rods in and out of the core. If the power should rise too rapidly, automatic devices trip the safety rods and close down the reactor.

Besides, as the temperature inside the reactor rises, neutron production falls off; this is an inherent feature of nuclear reactors based on the well-known "negative temperature coefficient of reactivity."

Thus it is impossible for the reaction to "run away"—either from accident, negligence or sabotage.

Philadelphia Quartz Unveils Water Purification System

His new method for purifying and clarifying raw waters, according to inventor Harold Hay of Philadelphia Quartz Co., has conventional processes beat cold.

At least several eastern municipalities and paper mills seem to think so. Recently PQ granted licenses to them without royalty fees; they have adopted the method, and this month are using it in full operations.

The system consists of adding chlorine to a dilute solution of sodium silicate, aging the resulting coagulant, diluting the coagulant, and then adding it to the raw water along with one

of the usual coagulants (alum, ferric salts or lime).

Compared with conventional processes that use sulphuric acid, aluminum or iron salts, or ammonium salts with sodium silicate to form a coagulation aid, Hay's method has certain advantages:

- ▶ Simplicity: The new coagulant performs the sterilizing function. In standard purification a pre-chlorination step is necessary. Here it isn't.
- ▶ Efficiency: The sterilizing effect is at least as great and "is usually greater than that produced by the same amount of chlorine added in the conventional manner," Hay explains.
- ▶ Economy: Since chlorine forms the coagulant aid, the need for other chemicals as aluminum or iron salts is done away with. Also less chlorine is used in the final chlorinating step thus the cost of the chlorine "can be largely written off."
- ▶ Longer life: The residual chlorine is not dissipated as rapidly as in conventional pre-chlorination processes.
- ▶ Speed: Compared with the coagulation aid formed by adding sulphuric acid to a sodium silicate solution, flocculation is improved: Along with larger flocs the speed of formation is stepped up.

Diamond Alkali to Issue $25 Million Preferred Stock

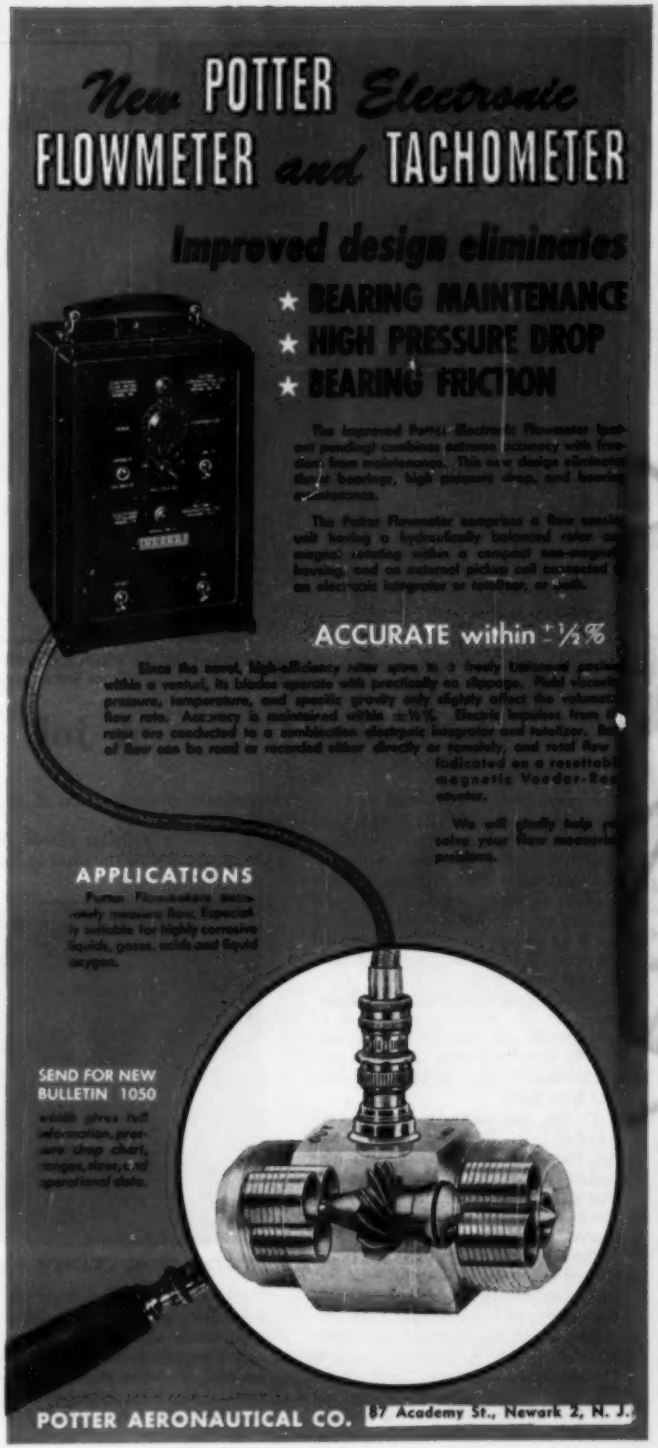
Diamond Alkali Co. has not had preferred stock for a number of years. But changes are expected to be made this month when stockholders act on the latest recommendation of the Board of Directors. The recommendation calls for a capital increase from $30 million to $55 million by authorizing $25 million of preferred stock.

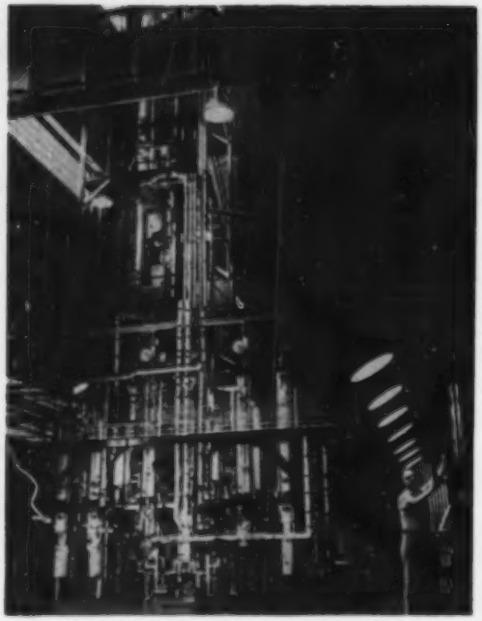
When the stockholders approve, Diamond plans to sell late in '51 or early in '52 through a public offering $12 million of convertible preferred stock of $100 par value. Conditions of the money market will have to be favorable, President Raymond F. Evans comments.

As another step in the financing program, Diamond will borrow before January $4 million under its loan agreement with Metropolitan Life Insurance Co.

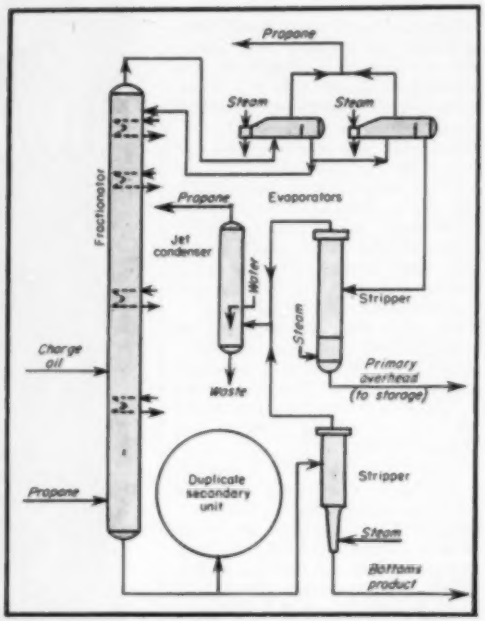
Diamond is getting set to launch a broad diversification program in the organic chemical field, particularly in chlorine-based plastics, solvents and insecticides. First step was the recent acquisition of the Kolker Chemical Works.

Another indication is the recent authorization to put up plants for the production of vinyl resins and improved insecticides at Houston and perchloroethylene at Painesville.





PILOT PLANT in which Kellogg first tried out use of its Solexol process in decolorizing and fractionating herring oil.



PROCESS calls for duplicate units. In second unit, bottoms from first unit are fed to fractionator with charge oil.

Solexol Process Gets New Job

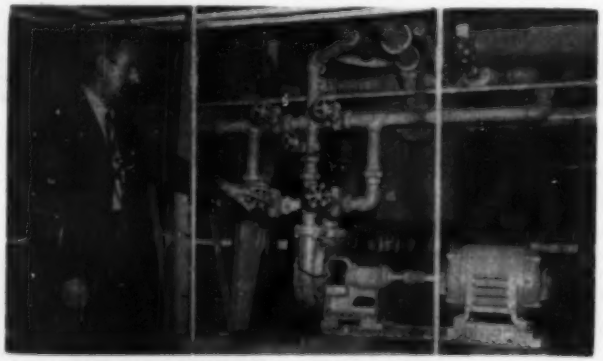
Flexibility of the Solexol process, developed by M. W. Kellogg Co. of New York, is pointed up by its latest application. A Norwegian firm has just contracted with Kellogg for such a plant to decolorize and fractionate herring oil into products that will be used for edible as well as industrial purposes. Estimated cost of the unit: over $1 million.

The Solexol process uses liquid propane for the selective separation of constituents of oil-bearing materials. Up to now, it's been used for processing applications in both the soap and food fields.

It has, for example, been highly successful in the fractionation and decolorization of vegetable and animal oils and in the production of vitamin concentrates from fish liver oils. Since Solexol is a low-temperature process and also permits, according to Kellogg, exceptionally close fractionation, it precludes damage to products from overheating and also provides for high purity of the individual fractions.

Several plants designed and built by Kellogg are in operation in the United States and one in South Africa. This is the first time, however, that any firm has used the process as a primary step in the production of edible products from fish oil.

De Nordiske Fabriker (De-No-Fa) is planning to locate the plant at Fredrikstad on the southeast shore of Norway. De-No-Fa will sell the edible products to manufacturers of margarine and shortening. Other products, having drying characteristics, will be sold to manufacturers of paints and varnishes. Capacity will be approximately 160,000 lb. per day.



NEUTRALIZING CYANIDE ON BEHALF OF FISH

Engineer George Dalrymple tries out one of the new valves on the cyanide neutralizing system at the Boeing Airplane Co. at Seattle, Wash. The pump and pipes handle water for the dilution of cyanide waste coming from the plating operations upstairs. Rectangular self-priming tank behind the pipes is specially designed. To assure steady operation, a small amount of air at its top forms a break. After being neutralized, the cyanide is spilled into the Duwamish River and Elliott Bay, harmless to all fish.

LARGE ELLIOTT MOTOR

...drives gas compressor

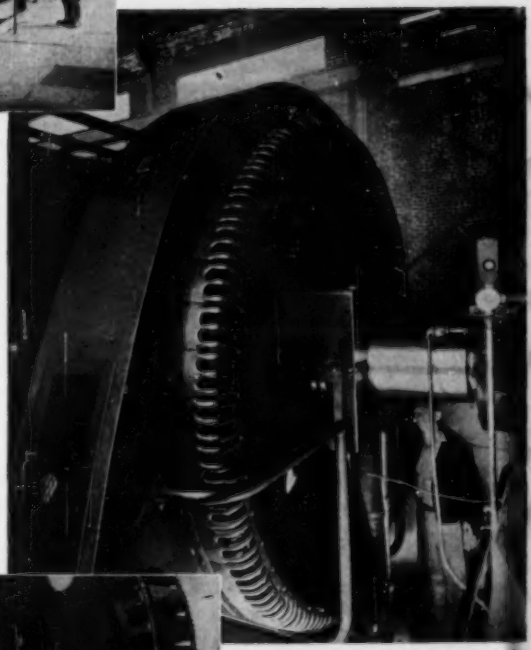
for maximum capacity

The I-R compressor and its Elliott motor in the new plant of the Long Island Lighting Company, at Glenwood Landing, N. Y.

At the new Glenwood Landing (N. Y.) plant of the Long Island Lighting Company an Elliott 2000-hp engine-type synchronous motor drives an Ingersoll-Rand type PRE-2-4C compressor to serve the rapidly expanding needs of Long Island's home developments.

With the flexibility of Elliott "Fabri-Steel" construction, the motor is designed specifically for its job. The rotor is split to permit mounting on the compressor crankshaft, and engineered with sufficient flywheel effect to prevent the reciprocating motion of the compressor from causing objectionable pulsations in the electrical system. Enclosed collector rings eliminate fire hazard.

The many superior construction details of Elliott low-speed synchronous motors are fully covered in Bulletin 5000-2. Address Dept. CE.



Close-up of the motor, showing explosion-proof, ventilated collector ring enclosure, with lucite windows for visual inspection.

The rotor is of full-split construction, with edge-wound copper strap field coils. Starting winding bars are silver-brazed to the end ring segments for low resistance and for permanent tightness.

ELLIOTT COMPANY

RIDGWAY DIVISION • RIDGWAY, PA.

U.S. PRIMARY ALUMINUM CAPACITY . . .

	Now	Going Up	Planned	By 1953
Alcoa				
Alcoa, Tenn.	290.6	–	–	290.6
*Badin, N. C.	86.7	–	–	86.7
*Massena, N. Y. . .	144.0	–	–	144.0
*St. Lawrence, N.Y.	110.0	–	–	110.0
Point Comfort, Tex.	114.0	70.0	–	184.0
Vancouver, Wash. .	152.2	–	–	152.2
Wenatchee, Wash. .	–	170.0	–	170.0
Rockdale, Tex. . . .	–	170.0	–	170.0
	897.5	410.0	–	1,307.5
Reynolds				
Jones Mills, Ark. .	197.7	–	–	197.7
Lister Hill, Ala. .	97.2	–	–	97.2
Longview, Wash. .	63.0	–	40.0	103.0
Troutdale, Ore. . .	144.0	–	4.0	148.0
Corpus Christi, Tex.	–	150.0	10.0	160.0
Site unselected, Ark.	–	–	110.0	110.0
	501.9	150.0	164.0	815.9
Kaiser				
Mead, Wash.	290.0	40.0	–	330.0
Tacoma, Wash. . . .	50.0	–	–	50.0
Chalmette, La. . .	–	200.0	200.0	400.0
	340.0	240.0	200.0	780.0
Anaconda				
Kalispell, Mont. . .	–	–	108.0	108.0
Grand Totals	1,739.4	800.0	472.0	3,011.4

BREAKDOWN shows, in millions of pounds per year, how production is expanding.

Aluminum Output Soars

Current expansion will double pre-Korea capacity for production of the silvery metal. Even so, defense planners are clamoring for a second-round increase.

U. S. producers of primary aluminum this year will produce a peacetime record 1,650 million pounds, up 17.5 percent over 1950. Steadily adding to capacity, they'll be turning out aluminum at the rate of 5 million pounds a day by the end of this year.

And within two years the big expansion they've embarked upon will double the industry's pre-Korea capacity of 1,500 million pounds a year.

Even before completion of the current $500 million expansion, a first round that will add 1,300 million pounds of new capacity by mid-1953, government defense planners (headed by DPA's new aluminum czar, Samuel W. Anderson) are calling for a second round to top the first with another 500 million pounds of new capacity.

The biggest chunk of new aluminum output is due during the second half of 1952. By the middle of 1953 the aluminum bottleneck should be broken. Meantime, the outlook for producers of less essential civilian goods is bleak.

Defense Needs: Direct military requirements, the stockpile and makers of essential products are getting 65 to 75 percent of primary aluminum output now, may get close to 90 percent in the first half of next year. Arms production—especially the aircraft industry—chews up the lightweight metal. For the first quarter of 1952, the Defense Department has been allocated 250 million pounds. At estimated production rates that's 40 percent of the supply.

Fourth-quarter allocations of aluminum for consumer durable goods are only 46 percent of their base-period use. And for the first three months of 1952 consumer durables are to be cut 14 percent more.

New Capacity: Four new aluminum plants are already under construction; two more are planned. Added capacity, either under construction or planned, will step up output at four existing plants. Before the outbreak of war in Korea, the industry had 12 primary aluminum plants, but Alcoa's St. Lawrence, N. Y., plant was shut down.

Under construction are 170-million-pound reduction plants at Wenatchee, Wash., and Rockdale, Tex., by Alcoa; a 160-million-pound plant at Corpus Christi, Tex., by Reynolds; and a 400-million-pound facility at Chalmette, La., near New Orleans, by Kaiser.

In addition, it's expected that Reynolds will put up a new 110-million-pound reduction plant somewhere in Arkansas, and that Anaconda will go ahead with a 108-million-pound plant at Kalispell, Mont., where Harvey Machine Co. had hoped to build an aluminum plant.

Alcoa is adding two pot lines to its Point Comfort, Tex., works; these are scheduled for completion next March or April and will have a capacity of 70 million pounds annually. At Longview, Wash., Reynolds is increasing capacity by 40 million pounds, and Kaiser is adding a like amount at Mead. These two expansions should be finished early next year. Reynolds also plans to add 4 million pounds to the annual capacity of its Troutdale, Ore., plant.

New Producer: Efforts of government officials, prodded by the Department of Justice, to get a new producer, preferably a small company, into the three-company industry didn't quite work out.

It takes an investment of about $700 to turn bauxite into a ton of aluminum. Add to that another $300 to $400 per ton for fabrication, and it's easy to see why aluminum production isn't too attractive to a small company, especially with most of the good hydro power sites already taken. The government finally got a new producer but not the small independent it wanted.

Anaconda will take over the $50 million project at Kalispell, Mont., for which Harvey had long sought a government loan. Anaconda will put its own cash on the barrelhead. For relinquishing the Kalispell site and tossing in his Bonneville power contract Leo Harvey will get from Anaconda "a small minority interest" in the operation. For Anaconda, the

* Alcoa currently is operating 158,000,000 lb. of capacity from normally uneconomical power sources; 19,000,000 lb. of this capacity is at Badin, N. C., the rest is divided between its two adjacent New York plants, with 29,000,000 lb. at Massena and 110,000,000 lb. at St. Lawrence.

paper sculpture by gordon smith

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attention to quality in NIALK* chemicals persists even to the selection of containers which will most assuredly safeguard quality in transit

NIALK	Liquid Chlorine
NIALK	Caustic Potash
NIALK	Carbonate of Potash
NIALK	Paradichlorobenzene
NIALK	Caustic Soda
NIALK	TRICHLORethylene
NIAGATHAL*	(Tetrachloro Phthalic Anhydride)

*Trade-mark

NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, N. Y.

NEW ALUMINUM PLANT of Reynolds at Corpus Christi will cost $80 million.

move is a nice hedge against any inroads that aluminum may make into present markets for copper.

Currently, the world's copper mines are hard put to turn out enough of the red metal. But aluminum can be substituted for copper in many uses, especially in electrical goods, the biggest market for copper. General Electric, for example, has just switched from brass to aluminum in the manufacture of light bulb bases.

Timetable: First segment of the industry's new capacity came into production last June, when Reynolds opened an additional pot line, capable of turning out 50 million pounds a year, at Jones Mills. Next big increase will come at Chalmette, La., where Kaiser has one 50-million-pound line just about ready for full production. By next spring, Kaiser will have three more pot lines producing.

Each pot line in a reduction plant contains 75 to 150 pots, each reducing alumina to aluminum metal by an electrolytic process.

Hydro Headache: Scarce hydro power is the biggest headache besetting the aluminum industry. It takes 10 kwh. to make 1 lb. of aluminum; hence cheap power is essential to profitable aluminum production.

With cheap hydroelectric power sources dwindling, the industry is turning to natural gas as a power source. Practically the entire expansion program calls for use of natural gas. Alcoa's Point Comfort, Tex., plant was the first to use it, and the new plants at Corpus Christi and Chalmette will both use it.

Another new fuel for aluminum is lignite. A big deposit of this in Texas will be used as a source of fuel for Alcoa's new Rockdale, Tex., plant (see *Chem. Eng.*, Sept. 1951, p. 219). The cost of converting it into energy, after selling the byproducts, is supposed to be competitive with that obtained when the fuel is natural gas.

Gas adds over 1 c. a lb. to the mill cost of finished aluminum. That's approximately a one-third increase in power costs. And the future holds still higher rates. The 20-year contracts that the companies sign to be sure of their gas supply carry a boost in rates every five years.

If the pinch ever gets too tight in natural gas, the plants can be located near deposits of soft coal. But that means another boost in power costs, about 2 or 3 c. more on each pound of aluminum.

One way to get around climbing power costs might be to locate future aluminum plants outside the U.S., in places like Alaska, where plenty of cheap hydroelectric power waits only to be tapped. Alcoa has been eyeing Alaska, but has made no such move yet.

Northern Rival: Canada, too, has abundant hydroelectric power and promises to become a competitor of the U.S. in aluminum production. For one thing, wages in Canada are about one-third less than in the U.S. And Canada has so much hydro power that Canadian power costs were running only about one-third as much as U.S. costs even before the industry in this country began to shift to gas.

Canadian capacity is somewhat short of 1,000 million pounds annually. But the Canadians hope to double that.

At Kitimat in British Columbia, Aluminum Co. of Canada, Ltd., will put up a reduction plant that will turn out 175 million to 220 million pounds annually. In another expansion move, Alcan has started a reduction plant in Quebec. New capacity there, together with that of the new British Columbia plant, will boost primary aluminum production by 330 million pounds. Long before Canada can double its capacity, however, U.S. output will already have been expanded.

When the Pacific Northwest power shortage forced a shutdown in some U.S. aluminum output, the government passed up its quota for the stockpile rather than grab metal already allocated to civilian uses. There's a possibility that the extremely tight first-quarter 1952 supply and the threat of another power shortage in the Northwest this winter might make the government decide to pass up its quota again. Otherwise, it might impose a death sentence on some manufacturers of civilian goods.

Except for finding economical power, the U.S. aluminum industry is relatively free of long-run problems. There's plenty of raw material from which to extract alumina. About one-third of the bauxite consumed by the alumina plants comes from Arkansas. The rest comes from the Caribbean area. In both of the major sources, Surinam and Jamaica, there are plenty of reserves. And the companies are expanding both their mining and alumina production operations.

World Leader: The U.S. wrested world supremacy in aluminum production from the Germans in 1941, has held it ever since. This country has been accounting for about 40 percent of world output, and has been maintaining a better than three to one advantage over Russia's estimated output. Canada, with a 1950 production of 792 million pounds, is the world's second largest producer.

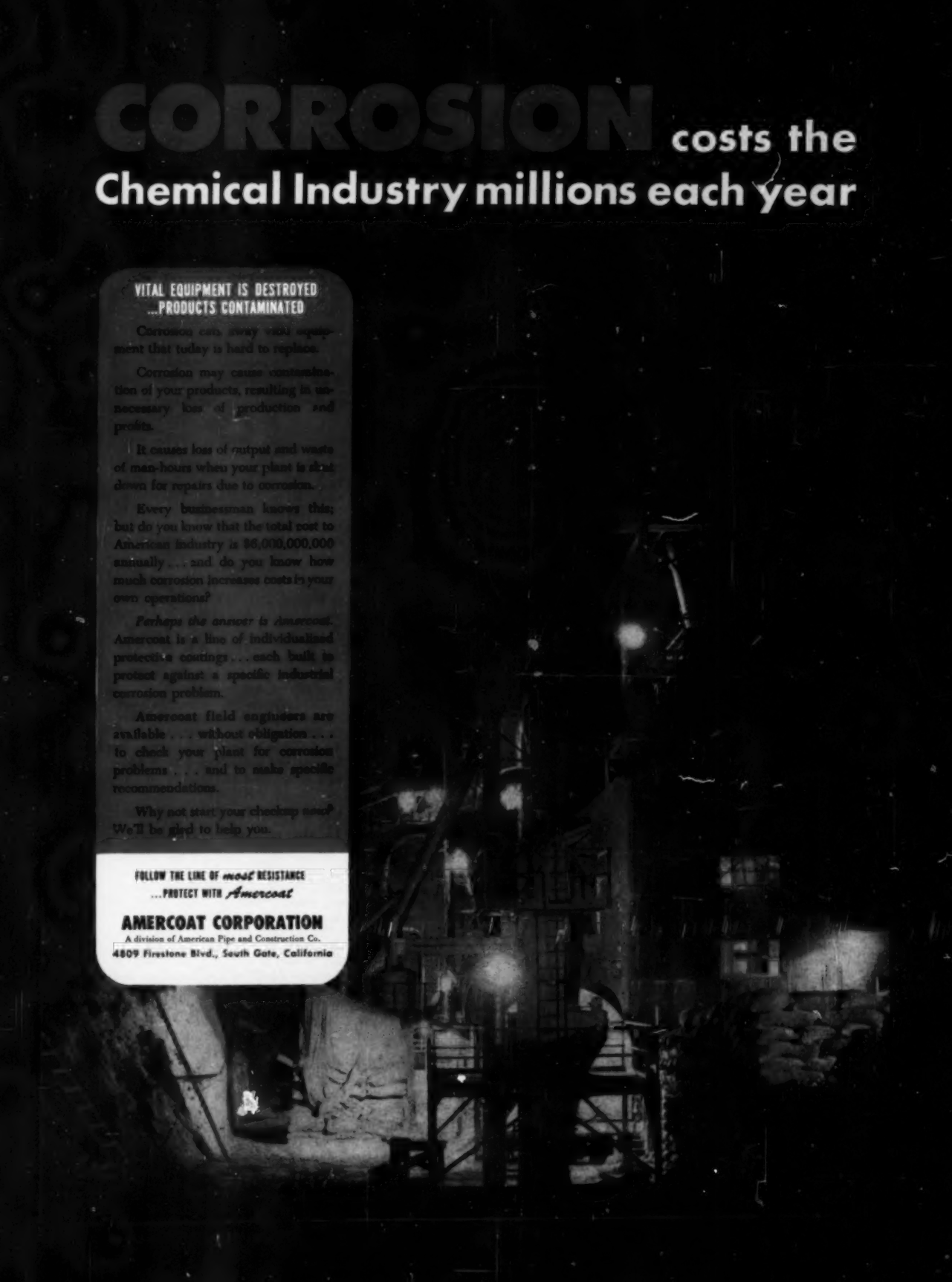
Aluminum has had a very fast growth, far exceeding that of steel and copper. Since 1939 production in the U.S. has increased 500 percent. Aluminum, which sells for 19 c a lb. in ingots and 18 c. as pig, now has about 4,000 end uses, supplied by about 17,000 fabricators in the U.S.

Future: The aluminum companies aren't worried about too much capacity after the current world crisis. Even if the military program ever slows up, they see golden profits for the silvery metal in such fields as construction, agriculture, electrical products and transportation. Two markets really tempt them—electrical conductors and autos.

An aluminum radiator would go a long way toward easing the tightness in copper. The auto makers are working on that problem now.

Both General Motors and Kaiser are working on an aluminum auto engine. Henry Kaiser says that an aluminum engine takes 200 lb. of the metal. If an aluminum engine is developed and goes into all autos, its production alone would require enough metal to absorb the entire expansion in capacity now planned for aluminum.

CORROSION costs the Chemical Industry millions each year



VITAL EQUIPMENT IS DESTROYED ...PRODUCTS CONTAMINATED

Corrosion eats away vital equipment that today is hard to replace.

Corrosion may cause contamination of your products, resulting in unnecessary loss of production and profits.

It causes loss of output and waste of man-hours when your plant is shut down for repairs due to corrosion.

Every businessman knows this; but do you know that the total cost to American industry is $6,000,000,000 annually . . . and do you know how much corrosion increases costs in your own operations?

Perhaps the answer is Amercoat. Amercoat is a line of individualized protective coatings . . . each built to protect against a specific industrial corrosion problem.

Amercoat field engineers are available . . . without obligation . . . to check your plant for corrosion problems . . . and to make specific recommendations.

Why not start your checkup now? We'll be glad to help you.

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Engineer Marnon, Director Bonnar, Engineer Hennessey and the redox measurer.

Engineers Solve Dye Problem

Latest development in the application of vat dyes: "One of the big steps forward in this phase of the dye industry since indanthrene blue was first synthesized in 1901."

A new method known as the Marhen process, made public last month, measures the reduction potential of vat dye baths. As a result, scientific control of vat dyeing is possible for the first time.

Developed by D. E. Marnon and J. H. Hennessey of General Dyestuff Corp. research staff, the Marhen process was called by J. Robert Bonnar, technical director of the corporation, "One of the big steps forward in this phase of the dye industry . . ."

Commercial acceptance seems assured. Some six leading mills have cooperated with General Dyestuff on many test runs; and, before the announcement of the development, considerable yardage already had been dyed successfully. "At each mill," inventor Marnon explains, "either better economics or qualities were shown."

Problem: For efficiency sake, the dyer must know the reduction potential (the power of the bath to reduce the dye and so fix it to the cloth) of his vat dye bath. The reducing power is a function of chemicals and temperature, and under ordinary conditions is continually fluctuating.

He must know before he acts. After he knows the reduction potential, he may then control the dyeing. With control, the dyer can apply necessary amounts of reducing agents and maintain a constant depth of shade.

Old Solution: Conventional methods for obtaining the reduction potential are not precise. Until now, dyeing with vat dyestuffs was an art rather than a science. To obtain the reduction potential, the dyer—like the cook without an exact formula—had to rely upon his own personal judgment. Not knowing the condition of the dye bath, he had to depend on experience and know-how.

New Solution: The Marhen method directly measures the reduction potential of the vat dye bath.

Known as a redox (reduction-oxidation potential) electrometric measurement, the Marhen method records on instruments the potential developed due to relative amounts of oxidants and reductants in the bath. It is similiar to the redox measurement used in the extraction of bromine from sea water; and is an example of the increasing use of redox measurements in the process industries.

The Marhen prototype machine, which was built by the electronic engineers at General Aniline's central research laboratory at Easton, Pa., consists of a modified Brown recording potentiometer, a Beckman pH meter, and platinum and calomel electrodes.

Results: The new method, which will be made available as a service to the customers of General Dyestuff, means many things to the dyer:

▶ A better product: The method makes for uniformity and constant shade in high quality dyeing, and with a savings in time.

▶ A savings in chemicals: Sodium hydrosulphite and caustic soda loss is reduced. Savings in hydrosulphite, according to Director Bonnar, in one operation amounted to two-thirds of the amount usually required.

▶ An elimination of repeats: Redyeing can be done away with because there is no longer any doubt of end results.

▶ An increased application: Dyeings of difficult fabrics are now possible. The inventors report dyeing for the first time the heavy fabric, 8 oz. Sea Island poplin.

Two Top Lumber Companies In Canada Become One

A top British Columbia lumber-pulp-plywood producer, Bloedel, Stewart & Welch, Ltd., had planned to build a new plant on Vancouver Island. However, one of their chief rivals, H. R. MacMillan Export Co., Ltd., already had a plant on the island at Port Alberni. Last month Bloedel and his partners scrapped their plans.

At the same time, the two firms merged. The new firm: MacMillan & Bloedel, Ltd. With assets of $103 million, it is surpassed only by the Weyerhaeuser concern in the U. S.

The new company will expand facilities. But instead of building a new plant, the present plywood mill at Port Alberni will be extended.

Plant capacity will be increased one-third. Additions will be made. New facilities include a continuous feed dryer, a new hot press with automatic loading and unloading, and an addition to the glue room.

Corn Has Hundreds of Uses In the Chemical Industry

Corn, which has kept the western hemisphere free from famines for hundreds of years, now supplies the chemical industry with products useful in several hundred applications.

So declared Ernest W. Reid, president of Corn Products Refining Co., last month in accepting the Chemical Industry Medal of the American Section of the Society of Chemical Industry at a dinner held in his honor at the Waldorf-Astoria Hotel.

"The diversity of its uses," he said, "ranges from various food products to foundry core binders, from baby feeding to the separation of ores, from textiles and paper to oil well drilling, from feed for farm animals to culture media for growing molds that produce

powerful disease-destroying antibiotics."

Grain is available for industry, particularly the chemical industry, because the productivity of our farms has been raised to new high levels. In a large part the chemical industry is responsible.

A few decades ago it took eight people on a farm to produce sufficient food for two people in the city. Today two people on a farm can produce enough food for eight city dwellers, Reid pointed out.

Gulf Oil Plans to Build Two Sulphur Recovery Units

Gulf Oil Corp. will build two sulphur recovery plants in Texas. One unit, the first of its kind in the Gulf Coast area, goes up at the company's Port Arthur refinery. Operation date: June '52. Capacity: 60 tons a day.

Sulphur will be recovered from the hydrogen sulphide removed from "off gases," a refinery byproduct. It will be converted into sulphuric acid for use in making alkylate.

The other unit will go up at Waddell, 35 mi. from Odessa. Sulphur will be recovered from hydrogen sulphide extracted from the 38 million cu. ft. of casinghead gas processed daily at the Waddell plant. Operation date: February '52. Capacity: 20 tons per day.

Kellogg Awarded Contract For First Refinery in Chile

M. W. Kellogg Co. will build Chile's first refinery. A contract has been awarded to them recently by Empresa Nacional Del Petroleo.

To be located near Valparaiso, the $10 million refinery will be up in about a year. It will have a 20,000 bbl. per day capacity, and process either imported or home crude oils.

Products from the new plant will include, aside from liquefied petroleum gases, motor gasoline, tractor gasoline, kerosene, two grades of diesel oil, and heavy fuel oil.

Process facilities comprise crude oil distillation, visbreaking, thermal reforming, thermal cracking, gasoline stabilization; and treating equipment for sulphur removal from fuel gas, liquefied petroleum gases and gasoline.

Stanolind Putting Up Sulphur Recovery Unit

A sulphur recovery unit is under construction at the Slaughter gasoline plant near Sundown, Tex. Stanolind Oil & Gas Co., who will operate the plant for a group of eight owners, expects to go on stream by March '52.

Recovery will be from hydrogen sulphide removed from casinghead gas. At the present time, the Slaughter plant processes 90 million cubic feet a day of casinghead gas that contains up to 7.5 percent carbon dioxide and up to 1.5 percent hydrogen sulphide. These gases, which are removed from the casinghead gas during processing, were formerly flared.

When completed, the new unit will recover about 40 long tons of elemental sulphur daily from 8.5 million cubic feet of acid gas.

Owners of the plant, besides Stanolind, are: Texas Co., Honolulu Oil Corp., Magnolia Petroleum Co., Devonia Co., Atlantic Refining Co., Saltmount Oil Co. and Mid-Continent Petroleum Corp.

Carbide & Carbon Develops Process for Dyeing Dynel

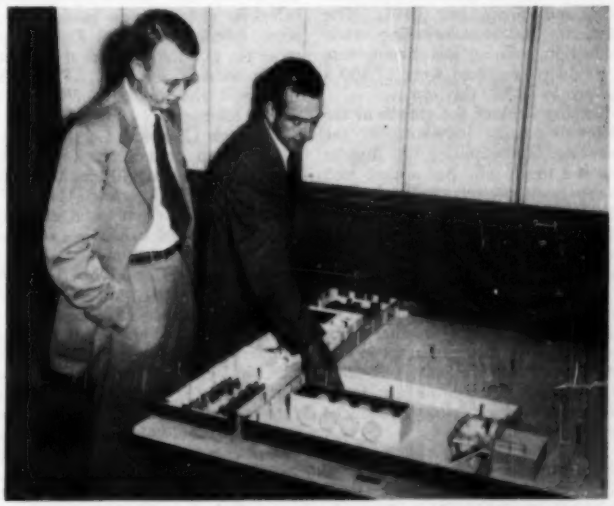
A new process has just been developed by Carbide & Carbon Chemical Co., producers of Dynel, for dyeing the acrylic staple fiber with mixtures of acid and acetate type dyes.

Principal feature of the new method, according to T. A. Field of Carbide's textile fiber department, is the addition to the dyebath of copper sulphate along with reducing agent. This permits (1) controlled rate of dyeing and (2) dyestuff exhaustion.

Normal dyeing procedure for Dynel takes place in a bath of mixed acid and acetate formulations. Dyeing, which is carried out at a boil, takes 20 min. After this time, sulphuric acid is added slowly to adjust the pH to about 5.5. In the new process, after an additional 20 min. of boiling, copper sulphate is added slowly until the desired degree of dyestuff exhaustion is obtained. The copper sulphate is mixed cold with a reducing agent outside the bath.

In the stock dyeing of Dynel for kersey (15 percent Dynel-85 percent wool), five steps are taken: preliminary dyeing, the "copper drip" period, resumption of dyeing, relustering with sodium sulphate, and rinsing and scouring. Total dyeing time: 5 hr. Estimated total cost: 23 to 25 c. per lb. of stock.

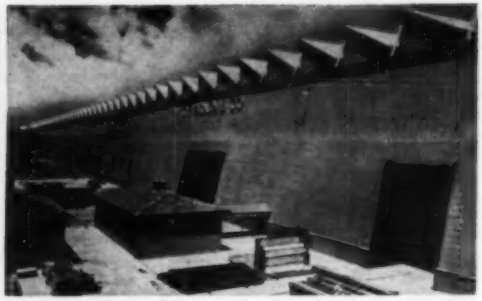
Proper heating and rate of liquor circulation are important in using the new technique. Rearrangement of heating coils may be necessary in certain types of equipment. Heating coils should be located in the surge tank rather than the dye kettle, except when open tubs are used.



USING A MODEL TO PLAN CONSTRUCTION 1,500 MILES AWAY

Keeping their eye on new construction, Bill Dabney, superintendent of assembly, and Ernest Gregory, Chattanooga plant manager, look over the model of the Chattanooga plant of Cutter Laboratories in the home office at Berkeley, Calif. As work progresses on the new $1 million plant, additions are made to the model. Later on, any reorganization or expansion will be worked out on the scale model by home-office engineers before building starts in Chattanooga.

Lever's $25 million plant is biggest in Los Angeles area.



Engineering firms like C. F. Braun & Co. are also expanding.

Chemicals Boom in Los Angeles

Within a year upwards of $50 million has been earmarked for expansion of diverse process industries in the area, with petroleum providing the biggest chunk.

Chemical process industries in the Los Angeles area have mushroomed in recent years as part of the explosive growth that has made the area fourth in the U.S. in population, third in number of plants and fifth in value of goods produced.

Employment in the major chemical and related fields, excluding the petroleum industry, increased from 13,800 to 15,500 between September 1950 and September 1951. The petroleum industry—including crude production, refining and manufacture of products—increased from 17,300 a year ago to 18,800 this year.

Keeping track of the growth of the chemical process industries in the sprawling, fast-expanding Los Angeles area is a tough job. But a close look at expansion projects undertaken by some of these industries between September 1950 and September 1951 gives a good idea of what has been happening.

Earmarked Dollars: Projects for expansion and new facilities announced during the past year in the major chemical and allied fields tot up to more than $52 million. Oil companies lead, with $39 million to be pumped into new projects announced during the year.

Petroleum: One big chunk of the money to be spent by the oil industry will come from Union Oil, which plans to add 40,000 bbl. a day to its crude capacity. Union Oil's project, slated for completion in mid-1952, includes a new fluid catalytic cracker, modification of a Thermofor catalytic cracking unit and addition of a crude vacuum distillation unit. And Union's new $8 million centralized research laboratory at Brea is almost completed.

A benzene plant, to cost more than $10 million, is a current project of Standard Oil of California. Located at Standard's El Segundo refinery, it's scheduled to start operating late next year. It will turn out 13 million gallons a year of benzene, about 15 percent of the total increase in benzene output by the petroleum industry called for early this year by the Petroleum Administration for Defense to meet the growing demand of the synthetic rubber industry. The new plant will also produce 3,200 bbl. a day of toluene.

Hancock Chemical Co. has spent $250,000 to expand its sulphur recovery plant, adding 30 tons to its 80-ton daily capacity. And Hancock's new $4 million glycol plant at Long Beach is expected to start turning out ethylene glycol and mono-, di- and triethanolamine this month. Hancock licensed its process from Societe Carbochimique, a Belgian concern.

Shell Chemical will erect a multi-million dollar synthetic ammonia plant in Ventura. It will supply nitrogen fertilizer and ammonia for manufacture of nitric acid, munitions, commercial explosives and paper pulp. "Sometime in '52" is the closest Shell will forecast start of construction.

Other Chemicals: Among major non-petroleum chemical companies, Stauffer has completed the biggest project during the year. In August it put its new sulphuric acid plant at Vernon in operation. It turns out 200 tons a day, double the capacity of its old plant. And at Callender, mid-way between Los Angeles and San Francisco, Stauffer is building a new citric acid plant that will use a new technique of accelerated molasses fermentation. Stauffer has also expanded its Los Angeles research facilities.

At Long Beach, Monsanto's polystyrene plant added a second production line this year, doubling capacity, though limitations on styrene monomer supplies have kept the plant from fully utilizing the new capacity. The Monsanto plant, only one west of the Mississippi producing polystyrene, markets about 90 percent of its product in Los Angeles County, but also ships throughout the western states.

A new resorcin plant, the West Coast's first, will soon be built by the chemical division of Borden Co. The $600,000 plant will produce at least 1 million pounds yearly. Borden says it will draw 90 percent of the raw materials—benzene, caustic soda and sulphuric acid—from the Los Angeles area.

Whopper: Biggest single plant opened during the year, and according to the Los Angeles Chamber of Commerce "the largest industrial investment made by private business in the history of Los Angeles County," is the $25 million plant of Lever Brothers, which started running in June. The plant, with a capacity of 80,000 tons per year, supplies the 11 Western States with Lever's soaps, detergents and shortening. It's a boon to local industry, since most of its raw materials come from nearby. Chief items: tallow, cottonseed oil, caustic soda, paper containers. Cost of Lever's plant is not included in the over-all investment total of $52 million for the Los Angeles area, since that figure represents only new projects announced this year.

New development in the drug industry in Los Angeles is the arrival of Strong Cobb, Inc., of Cleveland in the area. Strong Cobb expects its new plant in the Crenshaw Industrial

BLAW-KNOX *Announces...*

new tailor-made high capacity natural gas dehydration plants

OPERATING CONDITIONS

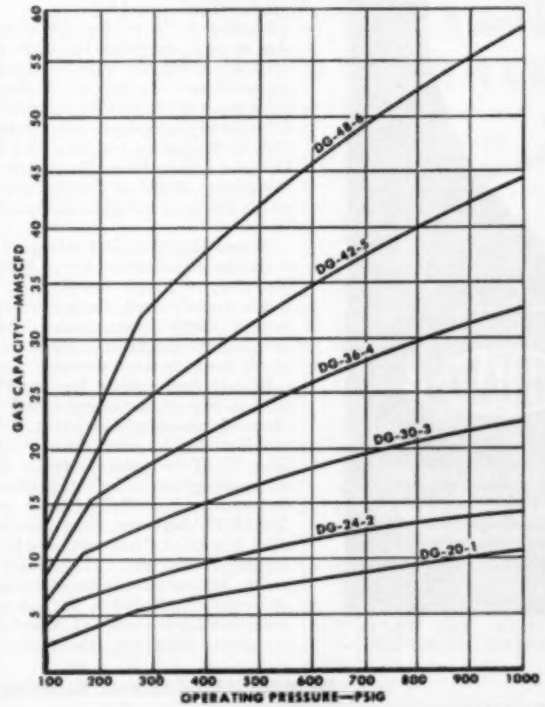
Gas Capacity at 500# and 1000# Operating Pressures for Blaw-Knox Standard Glycol Dehydration Units

Model No.	Max. Gas Capacity MMSCFD	Inlet Gas Temp. °F	Inlet Gas Press. PSIG	Dew Point Depression °F	Pressure Drop Thru Unit PSI
DG-20-1	7.3	80°	500	50°	3
DG-24-2	10.5	80°	500	50°	3
DG-30-3	16.6	80°	500	50°	3
DG-36-4	23.7	80°	500	50°	3
DG-42-5	32.0	80°	500	50°	3
DG-48-6	42.0	80°	500	50°	3
DG-20-1	10.5	80°	1000	50°	3
DG-24-2	14.5	80°	1000	50°	3
DG-30-3	22.7	80°	1000	50°	3
DG-36-4	32.5	80°	1000	50°	3
DG-42-5	44.7	80°	1000	50°	3
DG-48-6	58.0	80°	1000	50°	3

GAS CAPACITY OF BLAW-KNOX STANDARD GLYCOL DEHYDRATION UNITS VS. OPERATING PRESSURE IN PSIG

Inlet Gas Temp. 80°F Guaranteed Depression 50°F

Pressure Drop Thru Unit 3 PSI



Blaw-Knox now offers a line of natural gas dehydration plants that benefit from the economics and proved efficiencies in operation obtained by standard design, but which are flexible enough to meet the exact requirements of each customer's needs.

Check the adjoining table and chart for operating characteristics of the various models against your own requirements. A Blaw-Knox engineer will be glad to give you further data.

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2. Blaw-Knox high capacity natural gas dehydration plants are flexible because they are skid-mounted, prefabricated and assembled.
3. All Blaw-Knox high capacity natural gas dehydration plants are accessible, can readily be disassembled for maintenance. Individual components are interchangeable and the design features inherent flexibility.
4. Guaranteed to meet performance specifications which are based on actual field and engineering calculations.
5. Reliable. These units have long life and require a minimum of maintenance. Ask any of the Blaw-Knox satisfied customers.

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SPECIALISTS IN THE FABRICATION OF BULK AND FIELD STORAGE TANKS—HEAVY PLATE WORK OF EVERY DESCRIPTION

Tract to be in operation by February. The plant, which reportedly cost $384,000, will produce, package and distribute pharmaceutical products custom-made by Strong Cobb both for West Coast clients and national distributors with headquarters in the East who want to take advantage of lower shipping costs and other benefits of regional manufacturing.

Synthetic Rubber: Once again Los Angeles is a big factor in synthetic rubber production. The government plant at Gardena, formerly operated by Goodyear and U.S. Rubber, was reactivated this month at a cost of over $1 million by Midland Rubber Corp., a division of Minnesota Mining & Manufacturing Co. The plant employs 550. Its present capacity is 72,000 tons a year, but it's anticipated that it will reach 85,000 tons soon. Supplying the copolymer plant with butadiene is the RFC-owned plant operated by Shell Chemical, also reactivated this month. Supplying the styrene is the nearby plant of Dow Chemical Co., which, unlike the other two in this three-way operation, has never suspended production.

Being readied for production by February is the plant of U.S. Rubber's Naugatuck Chemical Division. With a $500,000 price tag, it's the first part of a big Los Angeles program planned by Naugatuck. It will manufacture Naugatuck's Lotol, Dispersite, Marvinol and Vibrin.

Plastics: $1.75 million for expansion or new enterprises has been announced during the year by plastics manufacturers. Largest single chunk is for the new plant of Pacific Optical Corp., newly formed subsidiary of McCulloch Motors Co., which took over Delriccio Laboratories. Production is just getting started in the new plant, which will turn out glass and plastic lenses.

Second biggest project this year by a plastics manufacturer is the $250,000 plant of Plastic Process Co. It means a modernized, streamlined operation. Plastic Process makes extrusions of thermoplastic materials for plastic products manufacturers.

Process Instruments: Significantly, manufacture of instruments used in chemical processing has increased in the Los Angeles area since World War II. Two major concerns, the Beckman group—including Beckman Instruments, Inc., Helipot Corp. and Arnold O. Beckman, Inc.—and Applied Research Laboratories, have both expanded this year. The Beckman group has increased its plant and office space by 40,000 sq. ft., and currently has 1,200 employees. The three companies comprising the Beckman

organization constitute the largest scientific instrument manufacturing unit in the West.

Applied Research, the other instrument concern to expand, specializes in spectrochemical equipment. It has acquired two new buildings, doubled in size, personnel and production during the year.

Engineering: Phenomenal growth has occurred in recent years among Los Angeles engineering firms in the petroleum and chemical field. C. F. Braun & Co. alone has added $2.5 million locally in new buildings and equipment in 1951, and this is a repeat of its expansion last year. Braun has spent about $13 million since 1945 on its plant at Alhambra, an expenditure that includes a $1 million research center and five other new buildings on the 50-acre site.

Fluor Corp.'s major expansion of the year is a $400,000 engineering building of 27,000 sq. ft., almost identical to one constructed in 1950. Fluor reports its biggest business backlog ever, upwards of $90 million.

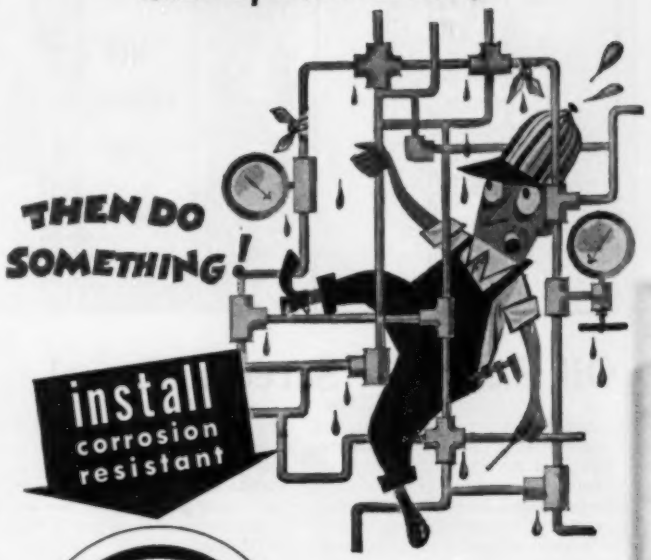
Ceramics: Los Angeles' ceramics industry has reported more than $2 million in expansion this year, with two companies accounting for most of the total. Gladding-McBean & Co. has added $1 million in new buildings and equipment in the Los Angeles area. It has upped refractories production by 30 percent, tile production by 20 percent, earthen ware by 25 percent and fine china by 20 percent. Gladding-McBean markets nationally, and has other plants in northern California and Washington that have also been improved during the year at a cost of $1 million.

General Refractories Co. will start making basic refractories in its new $1 million Los Angeles plant by the end of this year. The plant increases by 100 percent the Philadelphia firm's West Coast capacity for chrome-magnesite brick.

Paints and Varnish: Major undertaking in the paint and varnish field is that of Sillers Paint & Varnish Co., a Los Angeles firm marketing to the 11 Western States and British Columbia. Sillers will cap its postwar expansion by moving into its new $400,000 plant in mid-January. The plant will increase Sillers' capacity by 400 percent. According to company officials, it's the first large paint plant to use a modern non-gravity feed system, "change-can" premixer production-line techniques and other time-saving methods to increase production efficiency.

With one of the most highly diversified industrial economies in the nation, Los Angeles keeps growing. And so do the chemical process industries in the Los Angeles area.

Frantic
about pipe repairs and replacements?



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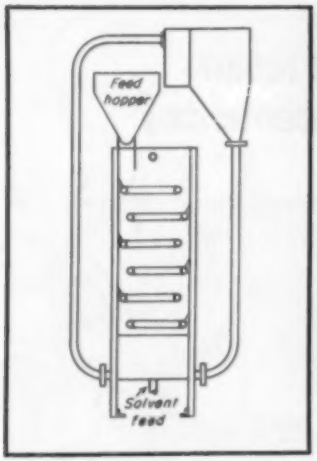
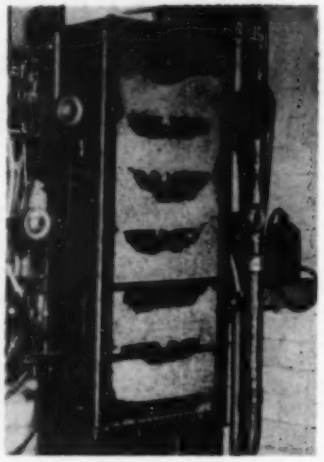




Oil Extractor Screens Travel

Although it was never tried before, research engineer W. D. Harris thought a traveling screen might do a better job controlling movement of the cottonseed flakes in oil extraction. In present commercial extractors of cottonseed oil—and particularly in the percolation type extraction he was working on—slotted plates and rotating rakes were no bargains.

Last month the successful operation of his pilot plant at the experiment station of Texas A.&M. proved he was right.

Because it has panned out in cottonseed extraction, the traveling screen idea may catch on elsewhere. Reports from the Texas Engineering Experiment Station and the Cotton Research Committee of Texas, sponsors of the project, indicate Harris' idea may be valuable in many other operations where solids are continuously and countercurrently washed. And it probably would be workable not only with liquid but with vapor and gas washings as well.

How It Works: Cottonseed flakes are fed from the hopper onto the top screen. A doctor blade regulates the thickness of the bed. The flakes, carried by six screens, pass downward through the solvent (isopropanol).

There is a 6-in. clearance between screens, which are staggered with alternate screens traveling in opposite directions. Flakes dropping from the last screen are elevated by a drag conveyor. Then they are dropped onto a slightly inclined canvas belt, conveyed to a suction box for drainage, and dumped into a meal dryer.

Vertical passages are allowed to become filled with flakes. A continuous moving serpentine stream from top to bottom of the extractor is formed. To keep these passages full, the bottom screen moves at three-fourths the rate of the other screens.

The screens are stainless steel woven mesh, 8 in. in width. They operate on 2-in. diameter rollers that are on 18-in. centers. The rollers are driven by a continuous chain.

Oil Find in British Columbia Stirs Up a Commotion

At Fort St. John, Pacific Petroleums, Ltd., made the first real oil find in the province. With this discovery, a minor stampede hit British Columbia last month.

In a four-day rush, 52 applicants sought oil rights to 4 million acres in the Peace River district. Imperial Oil, subsidiary of Standard of N. J., applied for 2½ million. The extent of the find, however, is unknown.

With their discovery, Pacific Petroleum reported 960 ft. of light gravity crude on a drill stem test, plus 125 ft. of gasified mud and 480 ft. of salt water. Alberta Petroleum and Natural Gas Conservation Board said the samples analyzed had a 38.7 gravity.

Negotiations for oil and gas pipelines to the Pacific Northwest via B. C. are going on. At this time Westcoast Transmission Co., an associate of Pacific Petroleum, seeks to build lines to the coast from northern Alberta and Peace River reserves. If proved commercial, the discovery will be important to the negotiations.

Herbicides and Defoliants Adequate for Next Year

Although demands are increasing, production of herbicide and defoliant chemicals will be adequate for the next agricultural year (see below). The forecast was made at a recent meeting in Washington of the National Production Authority and industry officials.

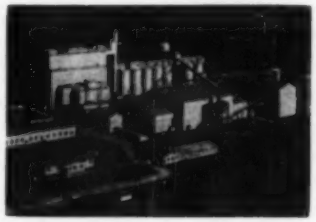
Brought out during the meeting was the fact that over 400,000 acres of range land were dusted during the past year with herbicide chemicals. Rangeland has been improved, and usage is increasing.

Defoliants, it was noted, have found their greatest use in cotton farming, as a preliminary to both mechanical and hand picking of cotton.

Herbicide and Defoliant Outlook*

	Need	Probable Supply
Sodium arsenite	5,000	5,600
Sodium chlorate†	30,000	40,000
2,4-D acid	23,500	23,000
2,4,5-T	8,000	8,000
Other	67,000	70,000
Total	139,500	150,600

* As thousands of pounds; For the agricultural year, October 1 through September 30, and includes exports. † Supplies for herbicidal and defoliant use only.



Silver Bow in '52

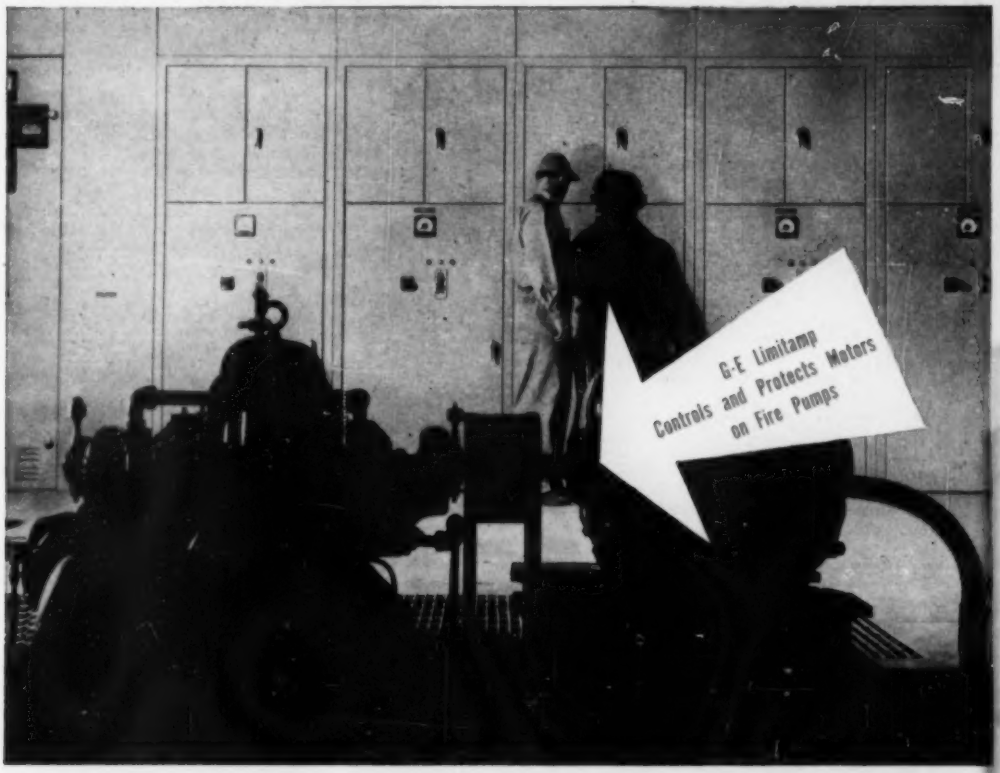
Montana's First Phosphorus Shipped From Silver Bow

Last month a tank car rolled out of Silver Bow, heading east to Chicago Heights, Ill. It carried the first elemental phosphorus ever produced in the State of Montana.

Preceding the trip lay two year's digging and building. Two years ago Victor Chemical Works, owners of the new Silver Bow plant, started working the large mineral reserves of phosphate rock in the nearby Melrose area. A year ago construction began on the new $5 million plant, and recently the first electric furnace was completed.

Now a second furnace is being put

TWO-WAY PROTECTION AT INTERNATIONAL



G-E Limitamp provides high-voltage control for five pump motors totalling pumping capacity of 17,000 gallons a minute at N. Y. International Airport

This fast-acting control is expected to put motors of 210 and 350 horsepower into immediate action in case of fire at the airport. Designed for heavy duty; corrosion resistant, and containing no complicated mechanism, Limitamp requires only routine maintenance—is always ready to go into operation.

Chosen for its high interrupting capacity and comparatively low cost, pre-engineered and factory assembled G-E Limitamp guards equipment against the ravages of short-circuit currents. G-E developed EJ-2 fuses interrupt the circuit within ¼ cycle. This prevents expensive, and possibly dangerous shutdowns.

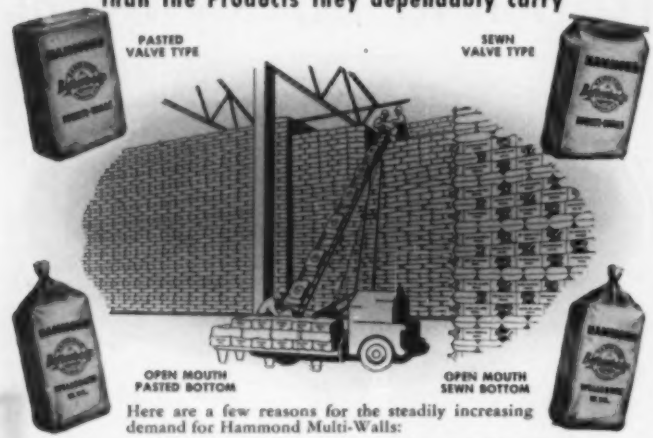
New compact design of controllers, many protection features, co-ordinated engineering on every job make this the high-voltage control (up to 4800 volts) you need for economy and protection. Write today for Bulletin GEA-5409A.

General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC

Much more goes into HAMMOND *Multi-Wall* BAGS

than the Products they dependably carry



Here are a few reasons for the steadily increasing demand for Hammond Multi-Walls:

1. Only papers and materials of highest quality are used in the production of Hammond Multi-Walls.
2. Hammond's two large plants are devoted almost exclusively to Multi-Wall Bag production.
3. Pride of workmanship and a thorough knowledge of your shipping problems assure you of Multi-Walls for your exact needs.
4. Modern machines and materials handling equipment keep costs and prices to a minimum.

Write for your copy of "To Serve You Better with Hammond Multi-Wall Bags"

HAMMOND BAG & PAPER COMPANY

***General Offices:* Wellsburg, W. Va. *Plants in* Wellsburg, W. Va. and Pine Bluff, Ark.**

This condenser is 10" DIA. x 12' tube length; Bundle ¾" O.D. type 316 Stainless tubes; Double tube sheet also of type 316 . . . manufactured by the Heat Transfer Division of DOWNINGTOWN IRON WORKS, INC. DOWNINGTOWN solicits your inquiry for heavy duty shell and tube equipment fabricated of Aluminum, Inconel, Nickel, Phosphor Bronze, Copper, Silicon Bronze and various grades of Carbon Steel. Some of these are welded by the Inert-Gas-Metal-Arc method. DOWNINGTOWN is experienced in building equipment with Bimetallic, Finned Tube and Impregnated Graphite.

Design and construction meet requirements of A.S.M.E. Code or other agency specified by customer. Equipment of our design is sold on a guaranteed performance basis or we will fabricate to customer's drawings. Modern facilities available for radiographing where required. *Remember:* "Your Needs are Our Specialty!"

Write on your letterhead for DOWNINGTOWN literature on shell and tube heat exchangers.

DOWNINGTOWN IRON WORKS, INC.
DOWNINGTOWN, PA.
STEEL & ALLOY PLATE FABRICATION
HEAT EXCHANGERS

NEW YORK OFFICE, 30 CHURCH STREET

up. It should start operating by mid-1952, and double present capacity.

At that time greater supplies of electric power will be available. The plant then will consume electric power equal to a city the size of Denver.

The Silver Bow plant is part of an expansion program that will make Victor the "world's largest producer of phosphorus and phosphate products," says president Rothe Wieg. Victor now has six furnaces in regular production: four in Mt. Pleasant, Tenn., one in Tarpon Springs, Fla., and the one in Silver Bow. When the program, which started in 1946, is finished next year, Victor will have spent over $20 million.

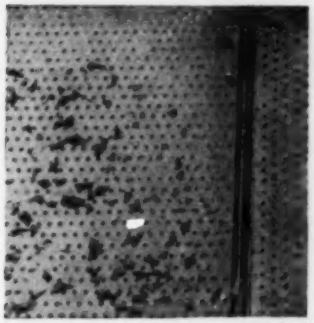
To handle the greater volume of phosphorus, the company has made sizable additions to processing facilities in its plants in Morrisville, Pa., Nashville, Tenn., and South Gate, Calif.

Automatic Gas Producer Reaches Pilot-Plant Stage

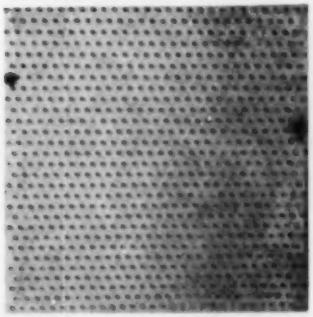
An improved gas producer, which can readily gasify coking and non-coking coals, has reached pilot-plant stage at the Battelle Memorial Institute in Columbus, Ohio.

The producer, besides its conventional operation, will make synthesis gas from coal, oxygen and steam. It was designed by Elmer R. Kaiser, assistant research director of Bituminous Coal Research, Inc.

Sponsoring the project, along with BCR and Battelle, are Glass Container Manufacturers Institute, Pittsburgh Plate Glass Co., Westinghouse Electric Corp., General Electric Co. and six members of the Diesel Engine Manufacturers Assn.



DIRTY stripping column trays at Phillips Petroleum are easily and inexpensively . . .



CLEANED and made ready for re-use in synthetic rubber production where . . .

Porcelain Enamel Can Be Substituted for Metal

Engineers at Phillips Petroleum had to find a substitute. In synthetic rubber processing, non - corrosive metals were formerly used for stripping column trays. But metals were so scarce it was almost impossible to get ahold of them.

After some mulling, they got the idea for the porcelain coating on ordinary metal. Erie Enamel Co. worked on it. The new trays were put in operation. Now after an extended period, field results were studied. Last month's reports were good, if not "remarkable," said Phillips' officials.

The new trays had a service record of 700 hr. between cleaning, 2,000 hr. between enameling. Approximate cost of maintenance: $0.42 per hr. per stripping column, which the company considers quite reasonable under operating costs today.

Control Costs with TOLEDO

On your scale material becomes money!

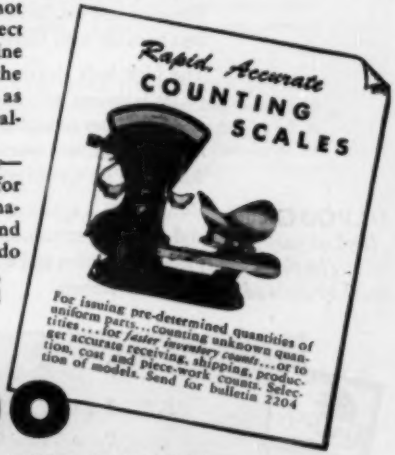
PRINTWEIGH STOPS ERRORS . . . Provides printed weight records—at the instant of weighing—assuring that the accurate indication of the Toledo dial will reach your accounting records without chance of human error.

Modern Toledos meet your needs today for *rapid, accurate* scales in all phases of production . . . to help you *control costs!*

These are the scales backed by Toledo's half-century of experience in Research and Engineering that has produced 80% of the major advances in scales during this time.

Toledo engineering has not only specialized in the direct design of weighing machine mechanisms, but also in the many associated fields such as electronics, plastics, metallurgy, optics.

Check your needs *now*—select Toledo equipment for vital jobs in guarding materials and costs! Sales and service in 200 cities. Toledo Scale Company, Toledo 1, Ohio. We will be very glad to send catalogs.

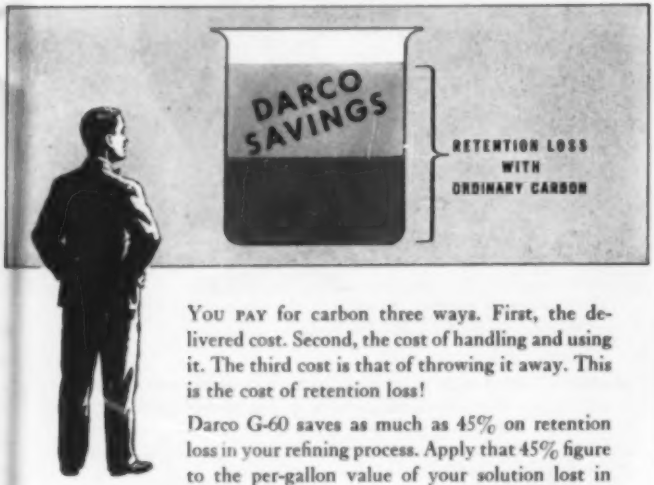

Rapid, Accurate
COUNTING
SCALES
For issuing pre-determined quantities of uniform parts...counting unknown quantities ...for faster inventory counts...or to get accurate receiving, shipping, production, cost and piece-work counts. Selection of models. Send for bulletin 2204

TOLEDO

HEADQUARTERS FOR SCALES

The THIRD Cost Goes Down When You Use DARCO G-60

Activated Carbon



YOU PAY for carbon three ways. First, the delivered cost. Second, the cost of handling and using it. The third cost is that of throwing it away. This is the cost of retention loss!

Darco G-60 saves as much as 45% on retention loss in your refining process. Apply that 45% figure to the per-gallon value of your solution lost in filtration and you have the dollars-and-cents savings possible with Darco G-60.

The high bulk density of Darco G-60 (25 lbs./cu. ft.) assures minimum volume of filter cake and minimum retention of your solution. And its high adsorptive capacity means that minimum doses give maximum results in purification.

DARCO G-60
Highest purity . . . by the gram or carload

Darco G-60 is specified by both research chemists and plant superintendents. Write today for complete information and a sample of this outstanding activated carbon.

DARCO DEPARTMENT
ATLAS POWDER COMPANY
Darco General Sales Offices
[illegible] 17, N. Y.

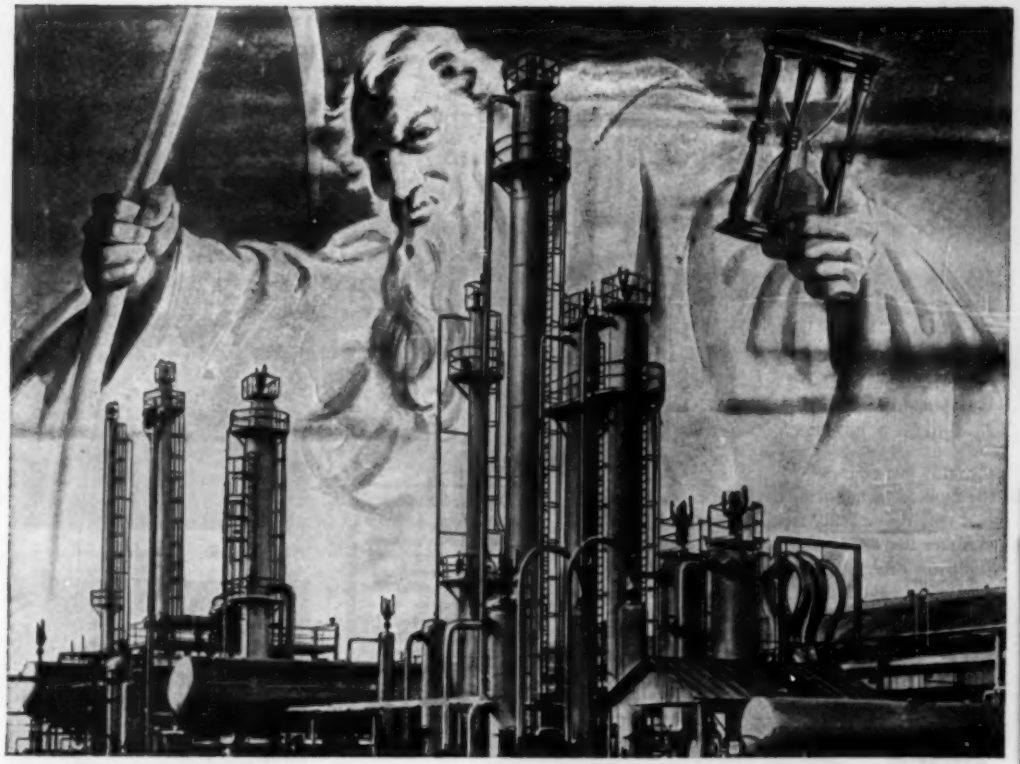
NEWS, cont. . .

Fertilizer From the Sea

SEAWEED piles up on a strip of Oregon beach after winter storms. Then a . . .

BEACH BUGGY goes out, scoops it up (3½ tons a stroke) and hauls it to . . .

DRYER at the plant of Soil Renewal Products Co. of Portland. After slow-drying to prevent iodine loss, the weed is ground and sacked. Company started production this year and expects to turn out 250,000 lb. of mulch before January.



Since 1929, A. O. Smith has been helping the petroleum, Petro-chemical, chemical and paper industries solve many of their difficult corrosion problems.

The Ultimate JUDGE is TIME

Smithlined vessels have been in continuous corrosive service for over 20 years without failure of the lining attachment or the vessel itself.

This history of service is significant. It confirms the findings of our own research laboratories and supports the designs of our engineers, that closely controlled resistance-welding of stainless or other corrosion resistant liners to carbon steel vessel walls is the best means of providing long-term service and satisfactory performance under specific corrosion, pressure and temperature conditions.

If you have a corrosion problem, let A. O. Smith work with you in solving it. Our engineers and laboratories have an unequalled background of experience and data gained from hundreds of successful applications of Smithlining. Contact our nearest district office.

77½ YEARS ANNIVERSARY 1874 · 1951

A.O.Smith

VESSELS • HEAT EXCHANGERS

Boston 16 • Chicago 4 • Cleveland 15 • Dallas 2 • Denver 2
Houston 2 • Los Angeles 22 • Midland 5, Texas • New Orleans
New York 17 • Philadelphia 3 • Pittsburgh 19 • San Francisco 4
Seattle 1 • Tulsa 3 • Washington 6, D.C.

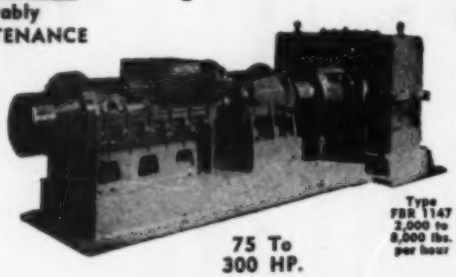
Continuous

WATSON

Unbelievably LOW MAINTENANCE

MIXING
MASTICATING
PLASTICIZING
COMPOUNDING

MODELS FROM 2,000 To 24,000 lbs. per hour



Type FBR 1147 2,000 to 8,000 lbs. per hour

75 To 300 HP.

The modern method of handling heavy, viscous or solid materials of any type. Engineered for long, uninterrupted service. Positive drive feeding device eliminates bridging, clogging. Jacketed for either heating or cooling. All wearing parts hard surfaced, readily accessible. Send for Bulletin.

Our Laboratory Is At Your Service to help solve problems of mixing, masticating, plasticizing, compounding. Experimental or lab oratory machine available for this work.

THE WATSON MACHINE CO. *Established 1845*

PATERSON 3, NEW JERSEY, U. S. A.

BENDIX FRIEZ

Bendix-Friez THERMISTORS

(NEGATIVE TEMPERATURE CO-EFFICIENT CERAMIC RESISTORS)

● These temperature responsive resistors are useful as temperature measuring elements and as liquid level sensors; they are especially well suited to compensation where the circuit constants must be maintained irrespective of temperature changes. Since they are a fired ceramic, they are stable under practically all conditions and respond only to temperature changes.

Many other values can be obtained from standard diameter material. Because the thermistors are made in our own plant, under extremely careful control, special compositions, shapes, and resistance values, hermetically sealed or otherwise protected, can be made in any quantities to suit your individual requirements.

We invite your Inquiries

Write Dept. G

BENDIX-FRIEZ STANDARD ROD TYPES

Size (inches)	@ +30°C.	@ 0°C.	@ −30°C.
.140 x ¾	45 ohms	88 ohms	193 ohms
.040 x 1.5	14,000 ohms	29,946 ohms	74,676 ohms
.018 x 1.5	40,000 ohms	94,040 ohms	262,400 ohms

Typical application in capsule form for temperature sensing of hydraulic oil.

FRIEZ INSTRUMENT DIVISION of
1324 Taylor Avenue • Baltimore 4, Maryland
Export Sales: Bendix International Division, 72 Fifth Ave., N. Y. 11, N. Y.

Bendix AVIATION CORPORATION

3RD FLOOR: Charging

2ND FLOOR: Mixing

1ST FLOOR: Cutting

Vertical Production Line Doubles Output

The new production line at the Johns-Mansville asphalt tile and Terraflex plant at Waukegan, Ill., is called the most modern of its kind in the world. Now in full operation, it has doubled their output of floor tile.

Whenever possible the $1 million line uses automatic controls: Temperature and length of time of mixing, quality of marbelizing splash (timers), the amount of milling (timers), and the degree of cutting (electric eye and light signals) are all controlled. Results is both constant color and physical characteristics in the finished titles.

Production is a three-level operation. The line starts on the third mezzanine of the plant. This is the charging floor. On the second mezzanine is the mixing operation. Here are located a battery of 1,000-lb. capacity mixers. The remainder of the production line—milling, calendering, waxing, punching and packaging—is on the first floor.

Reports from Users

Showing Typical Results on Corrosion-Control Problems where *Carpenter* STAINLESS No. 20 is used

Corrodent PRIMARY CONSTITUENT	REMARKS	PROCESS	RATING
Aluminum sulfate plus alumina	245°F.	Mfg. of aluminum sulfate.	Excellent, no sign of pitting after 35 working days.
Concentrated chlorine solution	— —	— —	Type 304 pitted. No. 20 satisfactory.
Fluoborate Plating Solutions	— —	Electroplating copper, zinc, etc.	Recommended for use in any of the commercial fluoborate plating solutions.
Maleic acid	30% concentration	— —	Excellent (better than Type 316).
Phosphoric acid	70% phosphoric 5% sulfuric some hydrofluoric boiling acid at 135°C.	— —	Excellent. Corrosion rate obtained: .0180 IPY.
Sulfuric acid	15/50% H_2SO_4 at room temperature	Nozzle for filling storage batteries.	Excellent.
Sulfuric acid	2 to 3% H_2SO_4 room temperature to boiling	Pickling tank.	Under severe working conditions Carpenter Stainless No. 20 showed no appreciable loss of weight due to corrosion (.00012 IPY).
Sulfuric acid	93% H_2SO_4 saturated with sulfur dioxide	— —	Excellent. Negligible corrosion rate (.00006 IPY).
Sulfuric acid	1% to 105% H_2SO_4	Die manufacturing. Heat exchanger coils.	Approx. 8 times as resistant as lead. Expected equipment life 4 years with Stainless No. 20.
Sulfuric acid	10% solution 140/160°F.	Acid dip pickling process.	Excellent.
Wet Chlorine Gas	— —	— —	Not recommended.
Zinc Phosphate	Solution contained approx. 5% sodium chloride at 180°F.	— —	Estimated life 10 to 30 times that of Type 302 or 304. Total exposure during test: 460 hours.

***NEW BOOK** describes Carpenter Stainless No. 20, its corrosion resistance and working characteristics. For your copy, just drop us a note on your company letterhead.*

THE CARPENTER STEEL COMPANY
127 West Bern Street, Reading, Pa.

Export Department, Reading, Pa.—"CARSTEELCO"

Carpenter

STAINLESS NO. 20

Licensed under patents of The Durion Co., Inc.

NEW USES FOUND FOR UNIQUE PROPERTIES OF METALLIC OXIDE PIGMENTS

Product Planning

Product Improving

You ordinarily think of metallic oxide pigments being used to produce coloring agents, catalysts, polishing agents and magnetic materials.

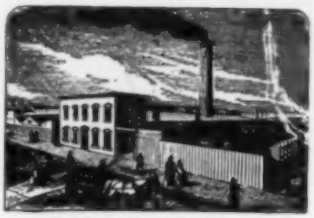
Today, however, new product planners and production engineers are finding uses for the unique physical and chemical properties of metallic oxides which are surprisingly far afield from traditional usages.

Below is a review of their characteristics. Look them over. You may get the germ of an idea which will lead to the improvement of existing products . . . or to the reduction of new product manufacturing costs.

Should an application suggest itself, write. We'll be glad to cooperate with you in exploring the possibilities. Address Dept. 3, C. K. Williams & Co., Easton, Penna.

Name	Properties	Characteristics
Pure Red Iron Oxides and Indian Reds	Fe_2O_3-98.5% SpG.-5.15 Color—Salmon to purplish red	**Composition:** The basic colors of the iron and chromium oxides are determined by chemical composition. Reds are ferric oxide (Fe_2O_3); yellows, hydrated ferric oxide ($Fe_2O_3.H_2O$); blacks, ferro-ferric oxide (Fe_3O_4); and greens, chromic oxide (Cr_2O_3). All these compounds are chemically stable and light permanent.
Pure Yellow Iron Oxides	$Fe_2O_3.H_2O$-99% SpG-4.03 Color—Lemon to dark orange	
Pure Black Iron Oxides	Fe_3O_4-96% min. SpG.-4.96 Color—Blue Black	
Pure Chromium Oxides (and Hydrates)	Cr_2O_3-99% SpG.-5.20 Color—Light to dark green	
Natural Oxides—Ochers, Umbers, Siennas, Metallic Browns, Red Oxides	Wide range of ferric oxide content and red, yellow and brown colors	**Particle Shape:** Physical properties such as oil absorption and suspension characteristics are dependent on particle shape, controlled by manufacturing processes.
Venetian Reds	Fe_2O_3-40% SpG.-3.45 Color—Light to medium red	**Size:** Color range is controlled by particle size—average size increases as color darkens. Uniformity of size determines brightness.
Cuprous Oxide	Cu_2O-97% min.	**Purity:** Freedom from impurities is essential for superior pigment properties and to prevent deleterious effects in end-products. Control of soluble salts, manganese and copper content are an important part of the Williams' manufacturing operation.
Extenders—Barytes, Calcium Carbonate, Calcium Sulfate, Silica	Wide range	

WILLIAMS
COLORS & PIGMENTS
C. K. WILLIAMS & CO.
East St. Louis, Ill. • Easton, Penna. • Emeryville, Cal.
108 shades and types of iron oxide pigments



Silicates: Philadelphia's First Plant

On July 21st 1831 Joseph Elkinton, a Quaker teacher at the Tunessassa Indian school up in New York State, shook hands with his first customer at his soap and candle shop. Some 30 years later son Thomas, branching out, invited customers to his new factory on 9th and Miflin Streets in Philadelphia.

Today, 120 years later, with three Elkintons on the board of directors and great grandson Tom Elkinton running the Eastern and Canadian companies, the soap and candle shop has grown into a North American enterprise—the well known Philadelphia Quartz Co.

Petroleum Expansions

Pontiac Refining Corp. of Corpus Christi will build a $2 million aviation gasoline plant.

Taylor Refining Co. of Corpus Christi plans a $3 million expansion at its plant. Additions: a platforming and benzene purification unit.

Sinclair Refining Co. will increase crude oil charging capacity of its Houston refinery from 85,000 to 110,000 bbl. daily. Output of 115-145 octane gasoline and butylenes for rubber production will be upped 100 percent. New facilities: 40,000 bbl. fluid catalytic cracking unit, crude unit, and steam generating plant. Cost: $28 million.

Briefs

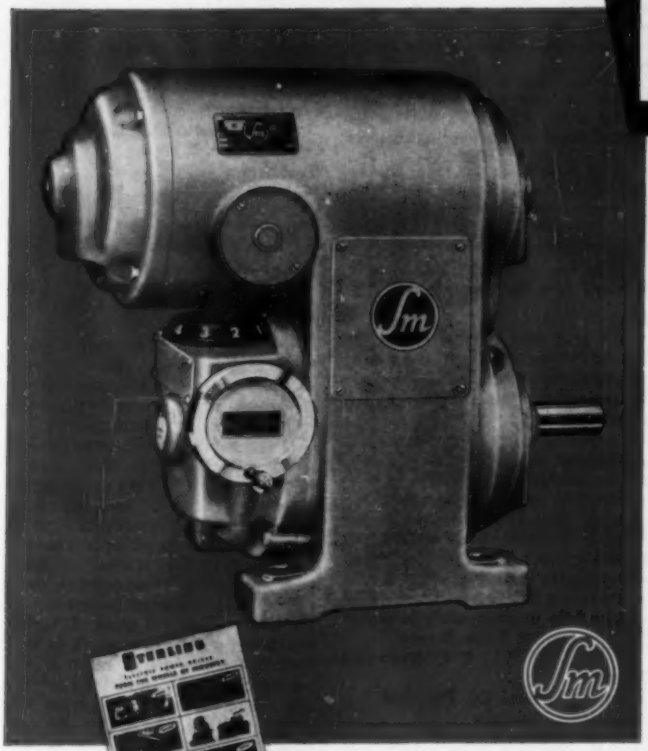
Benzene-Toluene: Great Southern Chemical Co. at Corpus Christi, Tex., has been given rapid amortization for tax purposes on units to produce of benzene and toluene.

Cryolite: Kaiser Aluminum & Chemical Corp. is putting up a cryolite recovery plant at its Spokane, Wash., aluminum reduction works. Key piece of equipment is a new $50,000 furnace. Recovery will be close to 100 percent.

power modernization

Even a brand new motor may be obsolete...

if you do not have control of speed



Ask for your copy of— pictorial bulletin No. A-53 showing Sterling Electric Power Drives Turning The Wheels of Industry.

A manufacturer of Food Processing machinery states,

"Speed-Trol made possible the design of a new de-watering press which resulted in:

26% greater moisture extraction-plus corresponding savings in the reduction process."

STERLING SPEED-TROL

...GIVES YOU VARIABLE SPEED CONTROL NECESSARY FOR:

PROCESS CONTROL OF: Temperature—viscosity—level—pressure—flow—etc.

TIME CONTROL OF: Baking—drying—heating—cooking—pasteurizing—soaking—chemical action—etc.

EQUIPMENT ADAPTATION TO: Load variation—sequence synchronization. Size—tension—hardness or shape of materials to be processed—machined—conveyed—blended—mixed—etc.

VARIATIONS IN: Quality—quantity—operators' abilities—etc.

STERLING ELECTRIC MOTORS

Plants: New York 51, N.Y.; Los Angeles 22, California; Hamilton, Canada; Santiago, Chile.

Offices and distributors in all principal cities.

Readers' Views & Comments

Mr. Madsen's Flexible Ruler

Sir:

Pointing out that the Cragoe equation can be used to estimate liquid viscosities, he advocated the use of a flexible ruler for determining graphically the last term in this equation. He stated that a ruler such as he constructed will describe a parabola, equivalent to the Cragoe correction term. Actually, the bending moment in all sections of a beam between the points of application of couples at the two ends has a constant value.

This means that the ruler describes a circular arc, not a parabola.

D. A. LARNER

Richmond, Surrey,
England

▶ *Correct. Mr. Madsen has rechecked his calculations and agrees.*

However, as pointed out in the original article there is another error due to neglect of the longitudinal stress. Since this opposes the error due to the assumption of a parabolic curve, the net error is very small. Hence, it can be assumed that the ruler approximates a parabola with sufficient accuracy for the use described, when the deflection is small. This was true in all cases encountered by the author.

In actual use, the ruler conforms to a parabola within the errors of graphical constructions.—ED.

z-Compressibility

Sir:

There are two omissions in my article "Converting to z-Compressibility" in your October issue which may cause some difficulty for the readers. On p. 144, the third line above Eq. 7 should read "and 1 atm. at 0 deg.C. it gives. . ." In the third column 15 lines above the references, the line should read "based on the property of the gas at 1.0 psia. . . ."

KENNETH A. KOBE

Dept. of Chemical Engineering
University of Texas
Austin, Texas

▶ *The two figures that were inadvertently omitted were 0 and 1.0.*—ED.

Scotched: Another Texas Story

Sir:

Just a friendly little reminder: you'd sure better be careful to check every statement inside and out, backwards and forwards, up and down, yea and nay, before you print it.

Now, for instance, take that simple little statement you made in your October *Chementator* (p. 108). . . . "Du Pont is the second largest stockholder of Phillips. . . ."

T.S.R.

Washington, D. C.

▶ *It so happens (as we now know) that this is a long-standing impression that's often taken as a fact, particularly in Texas and the Southwest—even by some Phillips people.*

The story got its start, it seems, a number of years ago when somebody spotted a Mr. Eugene E. du Pont on Phillips' board of directors. That much is true and still is. But du Pont as a company doesn't own any stock whatever in Phillips Chemical.

Having given a little life to any old Texas story, we're now delighted to kill the darn thing!—ED.

Boners Are International

Sir:

We read with interest your Little Boners . . . and it is comforting to us "down under" to know that American technology can get into bother just about as easily as we can.

In spite of our geographical position (or because of it) we feel that Boners are international. . . .

Seriously, we find *Chemical Engineering* extremely informative and helpful. Although we sigh for some of the products advertised which are not available in this country, the advertisements themselves as well as the articles help us enormously in our efforts to prevent Little Boners.

J. E. BREWSTER

Manager,
Learner Chemical Co. Pty., Ltd.
Melbourne, Australia

▶ *Yes, Reader Brewster, little boners are certainly international, God wot. Nor are they respectors of size or rank: some of our best Little Boners—real corkers—have come from proud and venerable chemical firms on three continents.*—ED.

Maintenance Costs—I

Sir:

I have discussed Mr. Leonard's article (Sept. p. 149) rather briefly with some of our engineers and have found considerable interest in it.

We do keep maintenance cost records on the various pieces of equipment in our plants but find great diversity for the same type of unit according to the conditions under which it is used and according to the occupancy hours. If average figures, such as those quoted by the author are to be used, they should be expressed in terms of repair material and of repair labor hours. The former could then be corrected by the Marshall & Stevens Index and the latter could be multiplied by the average rate of pay with overhead for a particular plant for the year in question. The dollar values as given have limited usefulness in their present form.

D. E. PIERCE

Chief Engineer
General Aniline & Film Corp.
New York, N. Y.

Maintenance Costs—II

Sir:

I have read the paper "What Does Maintenance Cost?" by Jackson D. Leonard . . . and I believe that I am in agreement with Mr. Leonard in almost every detail.

The idea of comparing cost of maintenance of individual pieces or types of equipment with a standard is excellent and can be made to point the way to reduced maintenance cost.

However, the implication that accurate cost information must be available is very plain. It is a much "larger order" to collect cost information on each piece of equipment or type of equipment than to set up a standard. Collection of this amount of detail adds appreciably to accounting costs, and the addition must be justified by the saving which will result. Whether this saving will occur depends in turn upon the use which is made of the information. The usefulness of the cost comparisons depends upon the accuracy of the information, the uniformity of the composition of the figures which are being compared, and eventually upon the clarity with which these comparisons point the way to improvements and savings.

The most simple form of cost information is where each piece of equipment which may incur important maintenance expense is covered with an individual account. This makes for a more voluminous record than when all identical or similar pieces are collected into individual accounts. However, cases where several pieces of equipment are identical in construction and used in identical service, are not usually as numerous as it might seem on first thought. We have found, however, that where the

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Du Pont Crystal Urea's properties make it a profitable chemical for other industries, too—for example, in flame-proofing compositions, toothpaste and adhesives. They also suggest many new applications. A few possibilities are: in refrigeration brines, in face powder and in agents for breaking water-oil emulsions.

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Technical bulletins on Crystal Urea and the chemicals and plastics used in your industry are available. Each product bulletin in the booklet presents physical and chemical properties, description, specifications, uses and possible applications, bibliography and other data. Write us on your business letterhead for your copy—and please tell us the name of your industry or type of application that you have in mind.

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composition of the group is carefully done, grouping need not impair the usefulness of the cost figures; otherwise, the figures will be more dependable if collected on individual pieces of equipment.

Standards suggested by Mr. Leonard are stated to cover a wide range of service conditions, and in the majority of cases show a rather wide spread, percentage-wise. This serves to illustrate the effect of service conditions upon maintenance cost. From what he has said, I would expect him to agree that a comparison to a more precise determination of standard cost for an individual set of conditions would be even more valuable than comparison to an average of a rather wide range of conditions.

It has been my observation that where maintenance costs of individual pieces of equipment, or properly constituted groups of equipment, are systematically compared with the standard, and the high cost items thus identified are given a good engineering analysis, the cost of collecting this kind of cost information is a highly profitable expenditure.

L. A. DARLING
Engineering Service Division
E. I. du Pont de Nemours & Co.
Wilmington, Del.

No Feminiphobia?

Sir:

A letter to the Editor in one of your recent issues, which you entitled "Feminiphobia?," has recently been brought to my attention. I would like to point out that there are many women in engineering who do not share the writer's opinion or experience.

It is realized that certain inequities do exist but that the situation is constantly improving. The growth of the Society of Women Engineers reflects this encouraging trend. The members of this society are employed in the various engineering fields at a professional level.

Although we cannot speak for all women trained in engineering, we feel that the progress made by women in that profession has been very encouraging.

EVELYN JETTER
President
Society of Women Engineers
Queens, N. Y.

▶ *The writer of the June letter stated "There is no real shortage of engineers . . . as long as employers refuse chemical engineers who put on their applications 'sex: female.'"*—ED.

—*End*

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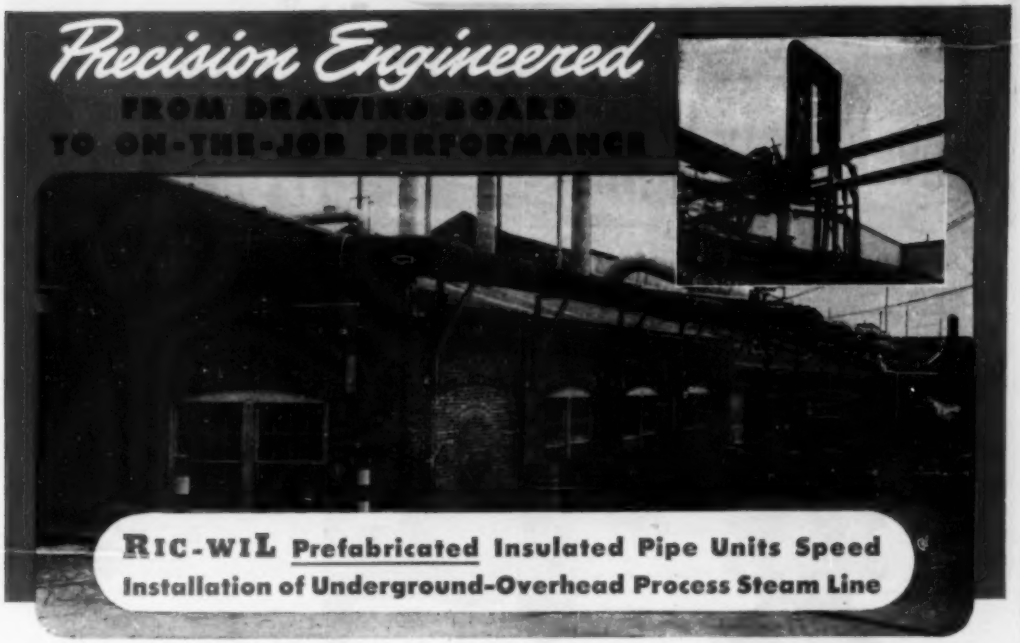

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A PROCESS STEAM LINE recently installed at a large adhesives manufacturing plant demonstrates many of the outstanding advantages of Ric-wiL *Prefabricated* Insulated Piping Systems.

Process steam leaving the boiler head at 145 psi is delivered to the adhesives mixers—a key operation—by a line constructed of Ric-wiL Hel-cor Pipe Units carrying an 8" steam pipe and 3" condensate return. Both pipes are insulated and housed in the same conduit, which runs underground beneath two railroad tracks and a concrete roadway as well as overhead between and alongside various plant buildings.

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Precision prefabrication, protection and insulation by Ric-wiL time-proved methods assure piping systems of high thermal efficiency, corrosion resistance, durability and strength, coupled with speedy, low-cost installation.

★ **Ric-wiL Prefabricated Insulated Piping Systems are made-to-order for distribution piping of process liquids, viscous fluids, oil, refrigerants, steam, hot or cold water. Ric-wiL engineers will be glad to consult with you on your insulated piping problems —without charge or obligation. For full information write The Ric-wiL Co., Dept. 50X.** ★

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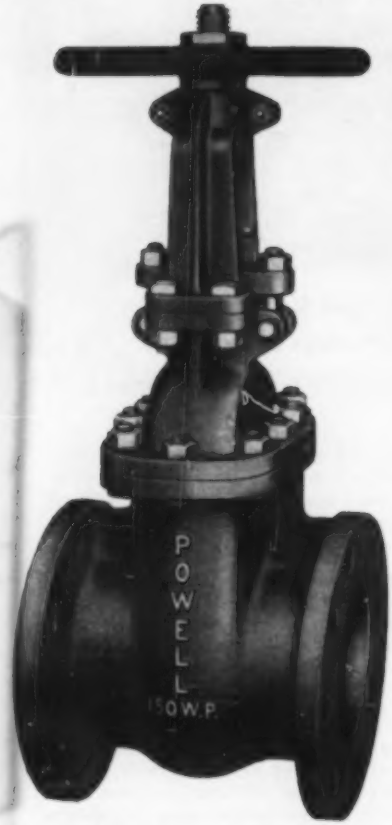

Fig. 2453-G—Large size 150-pound Stainless Steel Gate Valve. Made in sizes 5" to 30" inclusive. Has flanged ends, bolted flanged bonnet, outside screw rising stem and yoke. Separable yoke arms. Can be furnished with accurately guided, interchangeable solid or split wedges. These valves conform to all the latest standards. Available in a wide selection of other corrosion-resisting metals and alloys.

Fig. 1848—Small 200-pound Swing Check Valve with screwed-in cap and regrindable, renewable disc. Available in a wide range of corrosion-resisting metals and alloys.

Fig. 1832—200-pound Stainless Steel Gate Valve. Screwed ends, screwed-in bonnet, inside screw rising stem. Available in many other corrosion-resisting metals and alloys.

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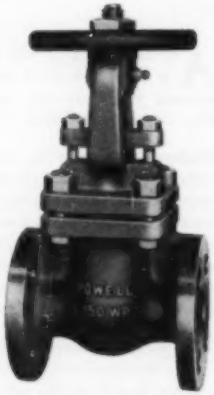

Fig. 2491—Flanged End O. S. & Y. Gate Valve for 150 pounds W. P. Supplied with precision-fitted, quickly interchangeable solid or split wedges. Stem is threaded and guided through a revolving bushing screwed into the upper yoke, which has a compression lubricant fitting. Made in a variety of corrosion-resisting metals and alloys. Also furnished with screwed ends.

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SPECIALLY DESIGNED 500 GPM WORTHINGTON TREATING SYSTEM at the new Pemex natural gas refinery in Poza Rica, Mexico. System includes cold-process slurry-type softener followed by acid feed, filtration and zeolite treatment. Engineered by Arthur G. McKee Company.

Specially Designed for Intermittent Service

Softening system for boiler feed water built for short-period operation, long shutdowns

Water conditioning requirements are especially tough at the new Pemex natural gas refinery in Poza Rica, Mexico.

Their need for variable-rate, continuous-service softener operation is complicated by the intermittent boiler feed-water storage demands.

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New Bulletin W-212-B5 gives you the vital facts about this unique cold process water softening method. Write for your free copy today.

Worthington engineers and builds equipment for all the major types of water-conditioning systems, therefore is in an excellent position to give comprehensive and well-balanced recommendations on your water-conditioning equipment problems . . . further proof that *there's more worth in Worthington*. Worthington Pump and Machinery Corporation, Water Treating Section, Harrison, N. J.

J.1.3

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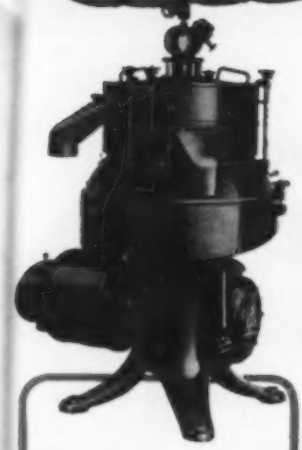

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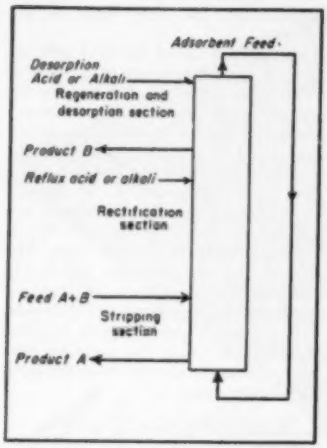
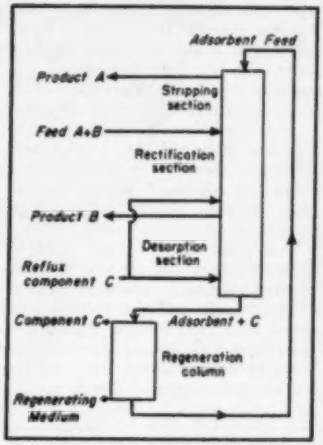
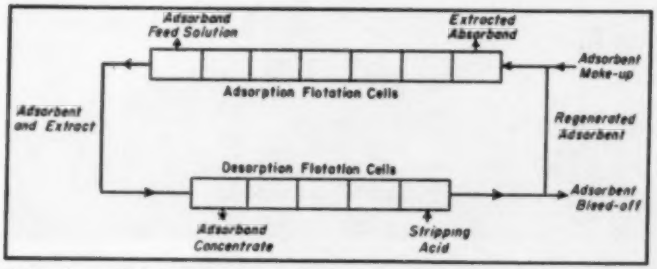


1. Fractionation of mixture A and B using acid or alkali reflux.



2. Fractionation of A and B using a solution of a compound C as reflux.



3. Continuous flotation adsorption and desorption unit for the recovery of cations. Interconnected cells are similar to those used in ore dressing.

Coming in Selective Adsorption

Three new processes which offer:

1. **Countercurrent contact, adsorbent floats**
2. **Countercurrent contact, adsorbent sinks**
3. **Multi-stage continuous contact**

Barriers blocking large-scale industrial use of selective adsorption and chromatography may soon crumble at several points—thanks to the work of Australian researchers. Broad aim of Donald E. Weiss and associates of the Commonwealth Scientific & Industrial Research Organization is to make selective adsorption a continuous process using adsorbents that are cheap and easy to regenerate.

To date they've come up with three new continuous adsorption processes. Two utilize flotation techniques and the third, a sink method. One of the flotation methods is carried out in a column, the other in a series of cells. The sink method is an adaptation of the column process.

In these flotation procedures, treatment of the absorbent with a modifying adsorbate increases selectivity of the adsorbent and conditions it for flotation. When applied to the separation of electrolytes, these modified absorbents resemble ion exchange resins in that adsorption and desorption may be controlled by pH adjustment. This technique overcomes the desorption difficulties of activated carbon. Therefore Mr. Weiss chose to use it as his absorbent because of its low cost and high adsorptivity.

1. Flotation in a column affords continuous counter-current contact as follows. Conditioned adsorbent is floated up counter-current to the descending adsorband stream. Introducing the feed containing the electrolyte mixture at an intermediate point divides the fractionating column into an upper rectifying and a lower stripping section. The pH determines adsorbate concentration at any point in the column. A pH gradient is obtained by adding acid or alkali at the top of the rectifying column which strips off part of the adsorbate ascending with the adsorbent from the stripping section and thus produces a rectifying action. The component most strongly adsorbed enriches the adsorbent emerging from the top of the column. This may then be recovered in a separate eluting column after which the regenerated adsorbent is recycled. The elution column may be separate from the fractionating column or may be built above it as an integral part of the column. (See cut No. 1).

Separation process may be controlled from measurements of the pH in the column at the feed-point. Decreasing or increasing the adsorbent flow controls capacity. A vacuum may support the liquid column simplifying withdrawal and feed arrangements. A slowly rotating agitator in the adsorbent bed sets up a spiral motion in the descending liquid and ascending adsorbent, increases the homogeneity of the bed, eliminates slugging in the column. The column process is independent of the particle size of the adsorbent. Finely-divided adsorbents with their highly accessible surface can be used.

2. Sink method adaptation of the foregoing has the adsorbent descending the column. Rectification is obtained by returning a portion of the product solution from the desorption section as reflux at the base of the rectifying section.

The density of an adsorbent may be altered by the attachment of air bubbles or by impregnation with a suitable liquid. Attachment of air bubbles

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is preferred because it produced a greater density difference.

3. Subaeration flotation cells, interconnected, similar in principle and design to those used in ore dressing are used to achieve multistage continuous contact. Here's how a three-stage unit works. Regenerated adsorbent, fed into No. 1 flotation cell, collects as a froth concentrate which is consecutively refloated in cells Nos. 2 and 3 and leaves the system as concentrate from cell No. 3. For more complete recovery of the adsorbent from the adsorband leaving the last stage, flotation cells Nos. 1 and 4 are connected as stripping cells.

Adsorbent may be regenerated by counter-current contact with a regenerating solution in a second series of flotation cells and the carbon circulated in a closed cycle. Appropriate adsorbent make-up and bleed-off compensate for mechanical losses and loss of adsorption capacity due to irreversible adsorption. Operation at a high pulp density improves flotation efficiency permits the use of cheap adsorbents of low adsorptive capacity. It also increases the adsorptive capacity of the cell by decreasing the time required to achieve adsorption equilibrium in each stage of the process.

Suitably designed flotation cells insure complete recovery of adsorbent. The right choice of flotation agents means extremely dry froth concentrates. A typical carbon concentrate contained 79 percent water by weight when kerosene was used as the collector and octyl alcohol as the frother.

Adsorbent tends to float rapidly out of the agitation zone of a cell. To obtain adequate contacting time, Mr. Weiss and his colleagues had to improvise on the design of standard equipment. Their flotation cell is similar to the original Hoover flotation machine in which the agitation zone is completely separated from the froth separation zone.

Monsanto Expands in Mexico

Although its new Mexican polystyrene plant (see cut) is not yet a year old, Monsanto Chemical Co. has found the market sufficiently good to expand their operation in that country.

The plant is now being equipped to turn out, in addition to the 7.5 million pounds of polystyrene capacity per year, a line of vinyl plastic materials.

The original Monsanto de Mexico plant outside of Mexico City was opened in February 1951. It cost $500,000 and is similar to the original Monsanto Queeny plant in St. Louis.

The Mexico subsidiary is a joint venture, with Mexican capital and U. S. know-how predominating. Raw materials are imported from the U. S., and, as the Mexican molders prefer to color their own molding powders, the plant has been supplying them with a small crystal colorant blend for their own use.

Monsanto says that the volume demand for plastics in Mexico is far greater than the country's present general industrial development would seem to warrant. But it exists.

While the plant has a capacity of 7.5 million pounds of styrene per year, Mexico is consuming only 4.5 million at the moment. What Monsanto has in mind is making Mexico a big exporting country such as Canada. This would call for Monsanta de Mexico taking over much of the Latin-American market. For the time being, this is hindered by a 15 percent Mexican export tax, but there are good hopes this will be removed in the not too far distant future. In the meantime, the domestic Mexican market is growing and by all indications will continue to grow by leaps and bounds.

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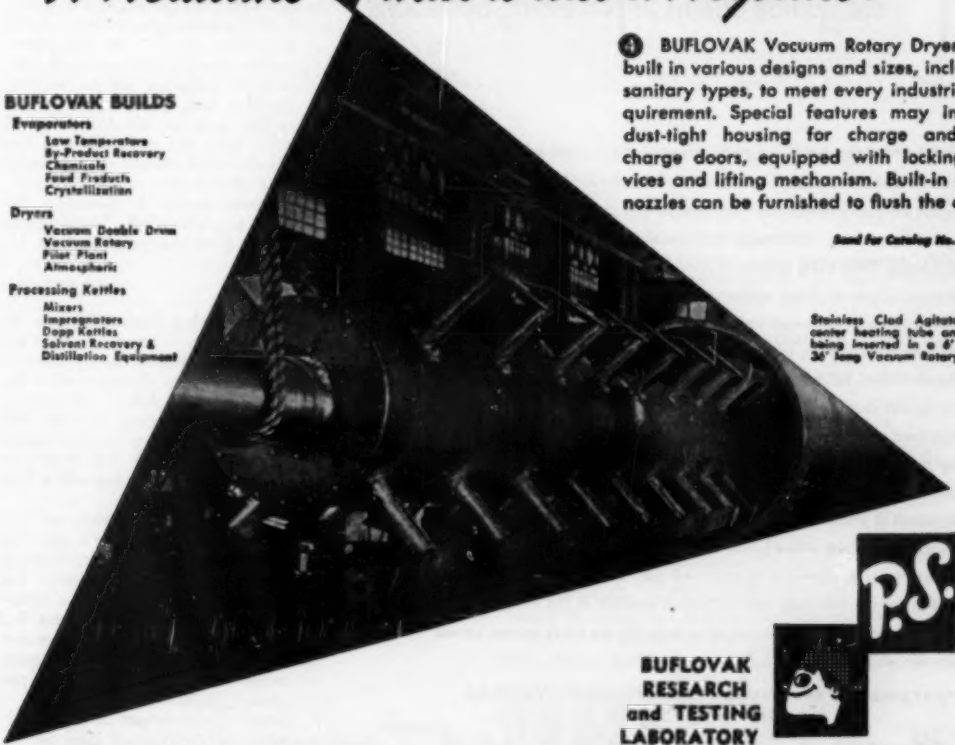

Stainless Clad Agitator with center heating tube and arms being inserted in a 6' dia. x 36' long Vacuum Rotary Dryer.

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Reported This Month

COLOMBIA

First major alkali production is about to start up in Colombia. The $15 million Bogota plant has an annual production capacity by the ammonia soda process of 36,500 mt. of soda ash. Produced from this are 18,250 mt. of dense ash, 9,125 of chemical caustic, 4,380 of bicarbonate soda and 3,600 of light soda ash. In addition a refined salt plant with a production capacity of 73,000 mt. annually will be built. Known as the Betania Alkali Plant, its design and operation have been under the direction of H. K. Ferguson Co.

Fertilizer plant to cost 11 million pesos will soon get under construction at Barrancabermaja near the oilfields on the Magdalena River. It will produce 6,060 tons ammonium anhydride from which 7,500 ammonium nitrate, 7,000 tons nitric acid, 7,500 tons nitrocalcium and 9,000 tons of ammonium sulphate are to be produced a year.

The necessary raw materials will come from the natural gas of the Casabe field which is not being used at present.

Local capital is financing the project. Chemical Construction Corp. is in charge of design.

GERMANY

The six existing Fischer-Tropsch installations in Western Germany are to be utilized again in the interests of the German economy with the least possible delay. At present several modifications to the F-T process are being tested experimentally and it is felt that only after a certain time lag will a final F-T synthesis evolve.

Economic exploitation of the Fischer-Tropsch process was defended recently by Dr. Tramm, director of Ruhrchemie. Dr. Tramm stated that in the course of time costs of the process had been lowered by 30 to 40 percent. Volume of the catalysts has quadrupled; 50 tons can now be produced daily, compared with a former daily output of 2 tons. In place of the former coke gasification, inferior brands of coal can now be used which might not otherwise find a market when production of high-grade coal becomes sufficient again.

According to Dr. Tramm, first

class lubrication oils can now be produced by the modern F-T synthesis; quality of the F-T-produced gasoline has been so improved that fuels with an octane rating of 70 to 80 are made available.

Plastic industry needs capital in the amount of $47.6 million during each of the next four years if new projects and processes, which now exist on paper only, are to be realized. Industry spokesmen, at their annual meeting in Wiesbaden recently, admitted that the industry itself would be unable to fill the demand for capital investments due to the present high tax burden. The only solution seems to be financial aid from the German government.

Industry representatives were told that the raw material situation will ease considerably in the coming months. This is attributed to relaxation of Allied restrictions on the production of chlorine, styrene, and synthetic ammonia. Further expansion of the industry must wait, however, until similar restrictions on the production of white phosphorus, phosgene, all alkylamines, ferrocyanide, synthetic rubber and oils are lifted.

AUSTRIA

Conversion into alcohol of sugar contained in the residue from the production of staple fiber from fir wood will be carried out at installations being built by Lenzinger Cellulose and Papierfabrik at Lenzing, Upper Austria, U. S. Zone. For every ton of staple fiber it is estimated that between 16.5 and 22 gal. of alcohol of 96 percent should be obtained.

INDIA

Synthetic oil will be produced in New Delhi according to an agreement made by a private firm in Orissa with a German and some French firms. The foreign firms will set up a gas producer and undertake construction work. The capital is being raised by the Indian firm partly in India and by a loan from a French bank.

Large-capacity oil refineries for crude petroleum are soon to be set up in India—probably one each by Standard Vacuum, Caltex and Burmah Shell, the three leading oil companies operating in the country. Each refinery is expected to cost up to $30 million and the total oil produced will meet a substantial part of India's 800,000,000 bbl.-a-yr. consumption. —*End*

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It's just common sense to do anything the simplest way—particularly if the results are superior to those obtained by other methods. This is especially true in the handling of bulk granular materials where DRACCO PNEUMATIC CONVEYORS provide many exclusive advantages.

DRACCO conveyors lower labor costs by reducing personnel necessary to transporting materials. Additional economies are produced by faster transfer of lower-cost bulk materials.

Dust hazards, contamination, and material losses are eliminated by DRACCO PNEUMATIC CONVEYORS which handle all materials in a completely enclosed system. Designed to your exact requirements, DRACCO conveyors require less of your plant's valuable operating space. Also, unlike mechanical conveyors, their top-efficiency operation is not affected by obstacles such as walls, floors and vertical heights.

DRACCO engineers, with over 35 years experience in reducing materials-handling costs, will gladly show you how DRACCO PNEUMATIC CONVEYORS may be used to lower your materials-handling costs. Call or write to

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1. Heavy steel plate
2. Bonderized surface
3. Formaldehyde-alkyd type medium-gray enamel
4. Two layers of Thermoset varnish
5. Final coat of dark-gray lacquer

Bonderizing and 4 protective coatings *ADD SERVICE LIFE*

All exposed parts of the Life-Line chemical motor are Bonderized. We know of no other motor manufacturer who assures longer life in chemical service with this extra protection. After Bonderizing, a special formaldehyde-alkyd type enamel is applied; then two coats of Thermoset varnish; finally a coat of dark-gray lacquer. On-the-job performance proves this is the best type of motor for chemical service.

"Longer Life... in chemical service" say these Life-Line users

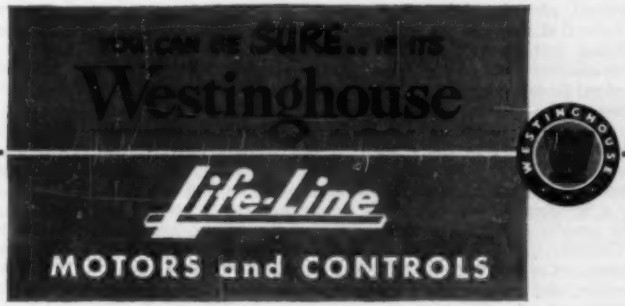
More and more plant operators confronted with the problem of operating motors for chemical processing are switching to Life-Line. They find that Life-Lines operate with less maintenance—AND have a greater life span. Here is an example:

Lubrication is a perpetual problem on a green liquor pump at the Weyerhaeuser Timber Company. Various concentrations of caustic and lime dust, together with frequent water splashing turn grease and oil into a soapy substance—useless for lubrication purposes. This problem has been eliminated, as far as the motor is concerned, by the installation of a Life-Line motor. The Life-Line has sealed, pre-lubricated bearings—keeps foreign matter out—needs no lubrication.

Proof of performance like this means your best buy for chemical motors is Life-Line. They are available in a complete range of enclosures . . . open—dripproof—splashproof—totally-enclosed fan-cooled—totally-enclosed non-ventilated. All have steel frames to effectively resist corrosion. All have sealed, pre-lubricated bearings that keep out destructive elements.

Cut down your motor replacement cycle with Life-Line. Your Westinghouse representative will show you how. Call him today or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-21634



Furane Cements:——————For your files—the corrosion resistance of a furane cement with maximum resistance to both acids and alkalis—polyfurfuryl alcohol resin with pure carbon filler.

With this issue we start a series of charts giving corrosion data for various materials of construction vs. a number of corrosives. Save these. Data for the corrosives of particular interest to you will be enlarged as the coverage grows to include all of the major materials of construction.—Editor.

Typical applications of furane cements: Bricks joined with a polyfurfuryl alcohol cement in a synthetic rubber plant (left), and in a corn products refinery (right).

Raymond B. Seymour & Robert H. Steiner,
The Atlas Mineral Products Co., Mertztown, Pa.

Furane cements are usually prepared on-the-job by mixing approximately two parts by weight of a powder with one part by weight of a liquid resin. The working times of the resulting mortars decrease with an increase in temperature; a working time of ½ hr. at 77 deg. F. may be considered as a standard. The cements attain an initial set within a few hours but the setting process is usually not complete until after several days. These cements do not attain maximum resistance to alkalis, salts, and solvents until they are completely set. However, since they are acid-catalyzed, they are often satisfactory for acid service shortly after the initial set has taken place.

Unfortunately, the various corrosion materials customarily classified as furane cements vary too widely in chemical resistance to be treated generically. Resins used for such cements may be based on condensation products of furfural and phenol, phenol and furfuryl alcohol, furfuryl alcohol and furfural, furfural and acetone, furfuryl alcohol and formaldehyde, as well as polymers of furfuryl alcohol. The problem is complicated further by the exploitation of blends of phenolic resins and polymers of furfuryl alcohol as furane resins.

The chemical resistance of the cement is also a function of the composition of the powder and the acid catalyst used. Commercial furane resin powders are composed of pure carbon, mixtures of carbon and silica, silica, mixtures of carbon and emery dust and asbestos.

Since furane cements with maximum resistance to both acids and alkalis can be prepared from polyfurfuryl alcohol and pure carbon, such a composition was used as the basis for the data presented in the charts that follow. This mortar contained a large reserve of catalyst to minimize the possible variation in chemical resistance which might result through the use of insufficient catalyst.

It must be remembered that corrosion is a complex subject and small variations such as impurities, aeration, turbulence and contaminants such as products of corrosion, may invalidate even the most precise recommendations. The data presented are based on both standard laboratory tests and practical field results but are essentially qualitative in nature and should be used primarily for screening purposes rather than for exact recommendation. Attempts to combine resistance data for blends of different chemicals should be avoided since generalizations based on mixtures of corrosive materials may lead to errors.

The laboratory test data presented in the accompanying charts were obtained at atmospheric pressure and, therefore, the upper temperature limit given is dependent on the boiling point of the solution tested. Extrapolation of corrosion data may lead to erroneous conclusions, but it may usually be assumed that a cement that is resistant at the temperature tested, will also be resistant up to the decomposition temperature of the cement. Most furane cements will withstand temperatures up to 375 deg. F. Corrosion resistance of cements cannot be represented as ipy. (inches per year) values since the materials are usually completely resistant or badly attacked. In some instances such as floor installations, cements may be used under conditions of slight attack but complete resistance is required for complete immersion.

With the exception of oxidizing agents and some solvents, furane cements are resistant at all temperatures up to 375 deg. F. and in all concentrations. The test data presented are limited by solubility of the compound under test. If a furane cement is reported to have satisfactory resistance to a compound at any specific concentration and temperature, it may be concluded that the cement will also be resistant at all lower temperatures and lower concentrations.

Furane resins have been proposed as membranes and experience during the past eight years has shown that such an application, while still in the development stage, shows some promise. However, all data presented relates primarily to the use of furane cements in conjunction with brick or tile. It must be remembered that in such applications, the physical and chemical properties of the brick and tile as well as those of the cement in question must be considered in the design of any structure.

Likewise, since even brick joined with furane cements are not completely impervious, they must be accompanied by an underlay of a properly selected membrane. There will be a temperature drop through the brick and the cement which will reduce the temperature and modify the effect of corrosion on the impervious membrane considerably.

Corrosive fumes...

Salt air...

Hot air...

Moist air...

SO WHAT!

"KARBATE" BRAND *impervious graphite pipe takes it all in stride!*

Have you thought about corrosion *on the outside* of your plant piping? Fumes, salt air, hot air, moist air, can eat up *the exterior* of piping, fittings, valves, pumps, and other equipment around a chemical plant. And it costs money to protect ordinary metal surfaces. You have to sandblast, use special coatings, and even then you find the corrosion creeping in and chewing up the equipment...

NOT SO WITH "KARBATE" IMPERVIOUS GRAPHITE!

Here are the advantages:

- **No exterior protection needed**
- **Both acid-resistant and alkali-resistant**
- **Light in weight, easy to machine and assemble**
- **No metallic contamination of product**
- **Immune to thermal shock**
- **Very high thermal conductivity**

The term "Karbate" is a registered trade-mark of Union Carbide and Carbon Corporation

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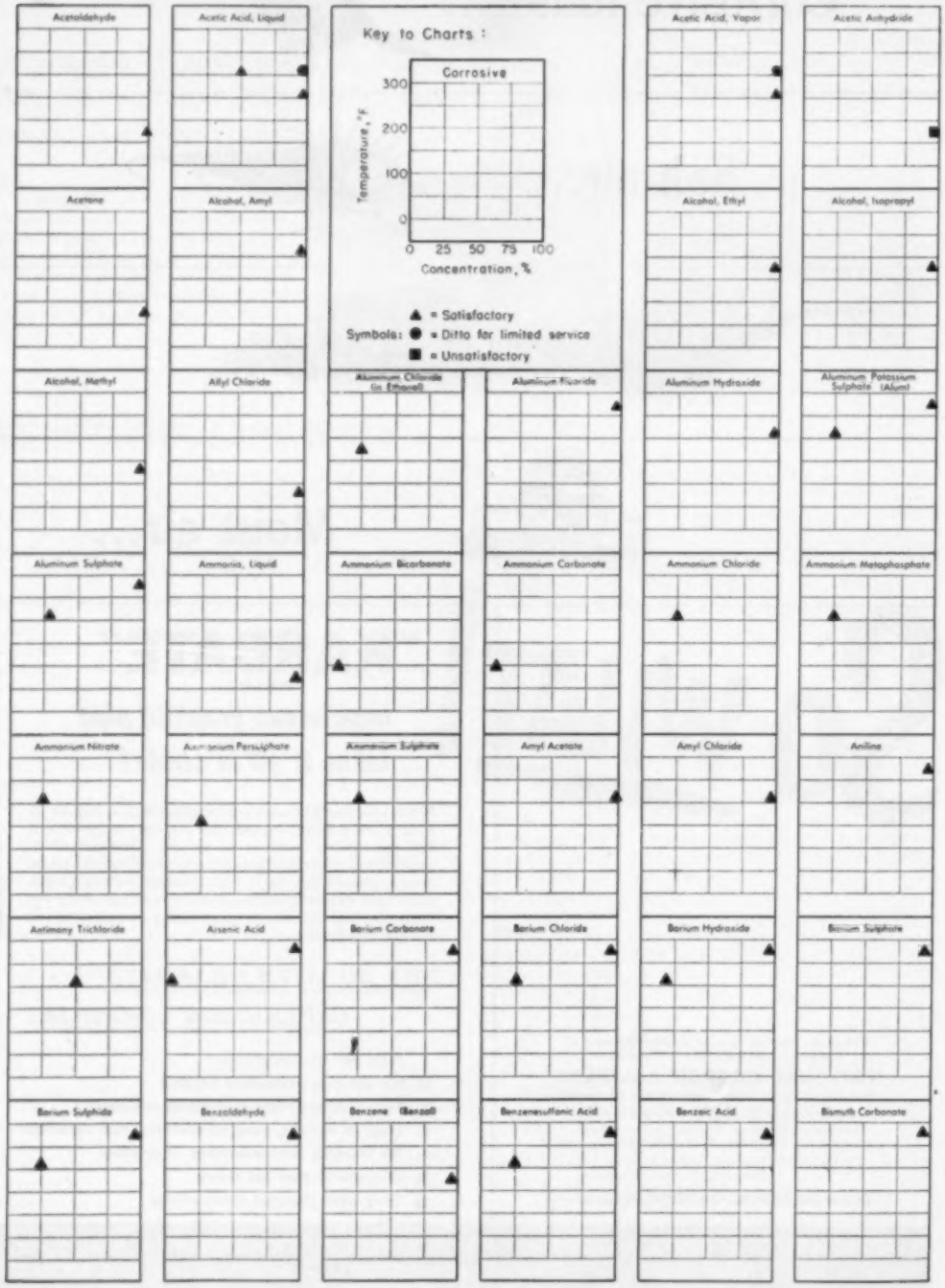
Corrosion Resistance of Polyfurfuryl Alcohol Resin Cements With Pure Carbon Filler



Engineers report:

"No Durco Type F Valve has ever stuck!"

A year and a half of careful checking of several thousand Type F valves in actual installations has not revealed a single case of sticking. Even in the toughest chemical service, the Teflon sleeve prevents freezing and insures ready operation.

Let us send you all facts about this sturdy, simple corrosion resisting valve.

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

A product of
The Duriron Company, Inc.
Dayton, Ohio

Manufacturers of corrosion resisting equipment exclusively since 1912.

Sizes: ¼" to 2"
Flanged ends

Sizes: ¼" to 2"
Screwed ends

Sampling valve
male or female
connection

Write for Bulletin 647

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ACID
PUMP
No Working
Parts!
New Merc-O-Pump gives constant, positive action employing a column of mercury as the liquid mover. Cuts operating costs and downtime. Air or steam operated. Rate: 3 gallons to 30 gallons per hour. Rate variable over entire range by external adjustment. Low initial cost.
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Corrosion Proof
Construction Materials
Corrosion Proof CEMENTS
A complete line of sulfur base, resin base, plastic and silicate cements. Write for bulletin 3-1.
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Permanent floors for chemical process, steel, textile, food industries, etc. Write for bulletin 3-1.
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Corrosion proof linings based on natural rubber, neoprene, saran, polyethylene, etc. Write for bulletin 4-1.
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Time-tested coatings based on vinyls, styrene, neoprene, saran, phenolics, furfuryl alcohol polymers, etc. Write for bulletin 7-1.
Rely on Atlas' years of experience and recognized leadership to help solve your problems. Write 10 Walnut Street, Mertztown, Pa.
Over a half century of service
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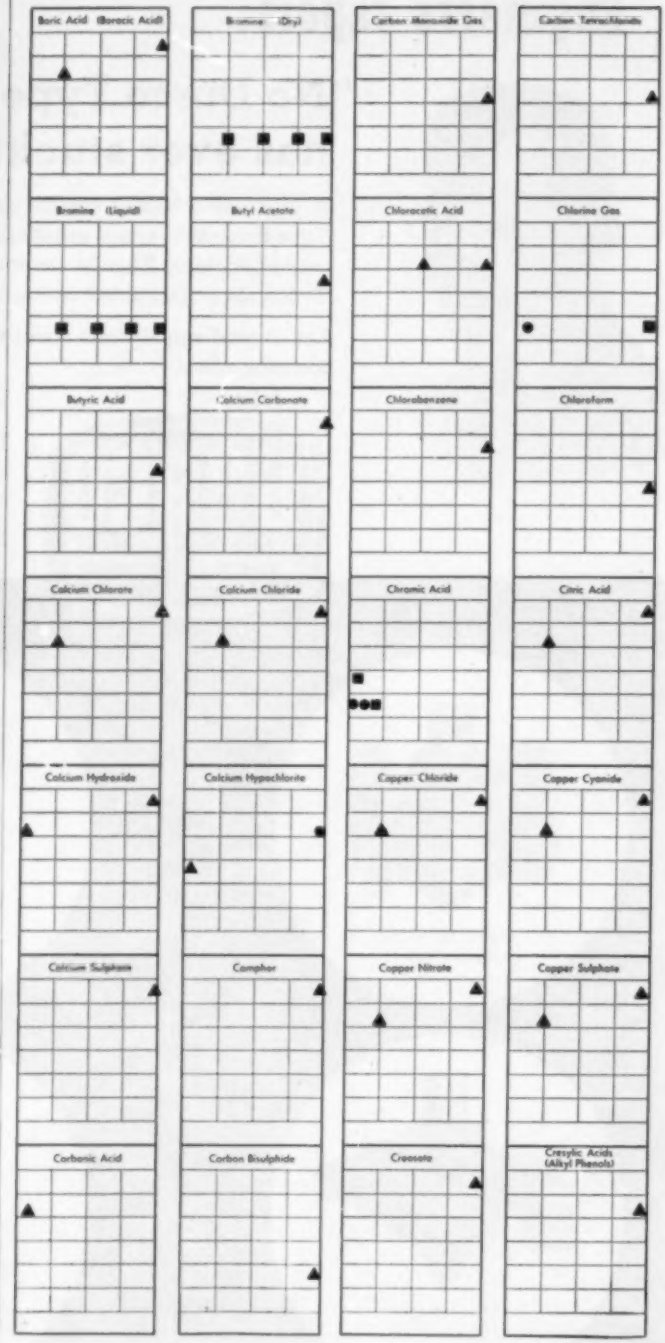
MINERAL PRODUCTS COMPANY

Key to charts is on p. 270



(Continued on p. 274)

NOW...THE WATER YOU WANT FROM THE WATER YOU HAVE REGARDLESS OF SOURCE

Actually you can obtain water of *any* desired quality from *any* raw water stock—with AMBERLITE Ion Exchange Resins! You may even deionize it in *one* pass through *one* exchanger column.

All you need is the right combination of AMBERLITE resins —and that's easy. Typical combinations work like this . . .

Strongly basic anion exchangers AMBERLITE IRA-400 and IRA-410, plus strongly acidic cation exchanger AMBERLITE IR-120, give you water with from 5 million to 15 million ohms resistance (less than 0.1 p.p.m.).

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AMBERLITE is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.

FULL TECHNICAL DATA WITHOUT OBLIGATION

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NEWEST WORD IN ION EXCHANGE

A method of using acidic and basic resins intermixed in a single unit. With Monobed, highest quality water can be obtained in one pass through one column. Ask for booklet, AMBERLITE MONOBED DEIONIZATION.

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Standard units 0.1 to 240 gpm—Special units to 1000 gpm—low first cost—low operating cost—unskilled labor — highest possible clarity. Process — potable — coolant recirculation — boiler-feed — campoute washing, etc.

CORROSIVES:
Nitric acid — sulphuric acid — chlorine — alkalies. There's a porous metallic filter that will do your job!

AIR AND GASES:
Whether it's solids from compressed air at 100 psi—or vaporized oil from air at 3000 psi — or process gas — MMC has a suitable filter.

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Headquarters For Your Filtration Problems

Regardless of the nature of your problem, liquid or gas, high or low temperature, up to 10,000 gpm, or 10,000 psi, let MICRO METALLIC filtration engineers recommend the filter to do your job with peak efficiency at lowest cost.

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HIGH PRESSURES:
A 13" long x 2" diameter MMC porous stainless steel cylinder offers less pressure drop to 3000 psi air than a 13" length of 2" pipe! For liquids too (even molten metals) at high pressure — MMC is the answer! Standard units up to 10,000 psi working and differential pressure.

FLUID CATALYSTS:
Petroleum and chemical fluid "cat" plants using MMC media offer:— 100% catalyst retention. Lower first cost than cyclone — electrostatic precipitator combinations. Examples of applications: — Hydroforming—phthallic anhydride manufacture.

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Whether a precious antibiotic to be quantitatively retained—or a waste product to be flushed down the drain—MMC porous metallic media pass more liquid and retain more solids than any other filtration medium!

GAS DISPERSION:
For hydrogenation — chlorination — oxygen stripping — varnish cooking — aeration of powder beds — dozens of other applications.

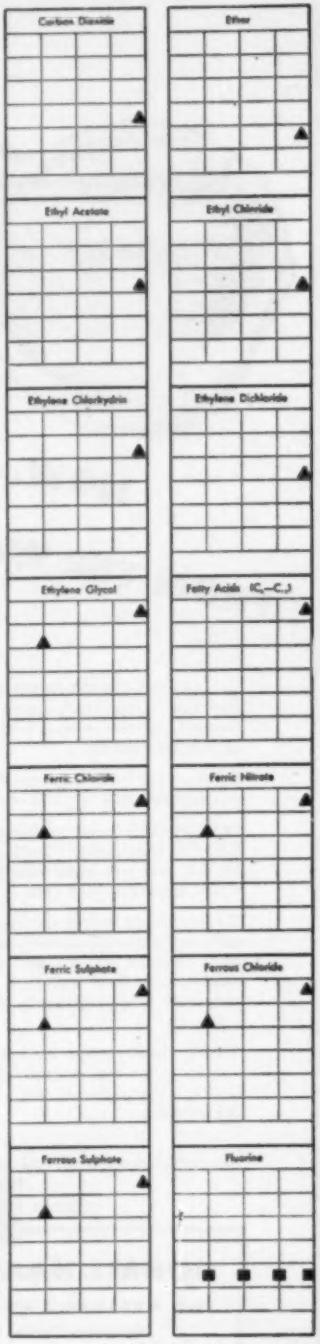
AND COUNTLESS OTHER APPLICATIONS:—

Anti-biotics
Steam
Fuels
Hydraulic oils
Television tubes
Synthetic fibers
Resins
Dust collection
Flow controls
Timers
Laboratory apparatus
Pilot plant equipment
Molten metals

and still more!

CORROSION FORUM, cont. . .

Key to charts is on p. 270



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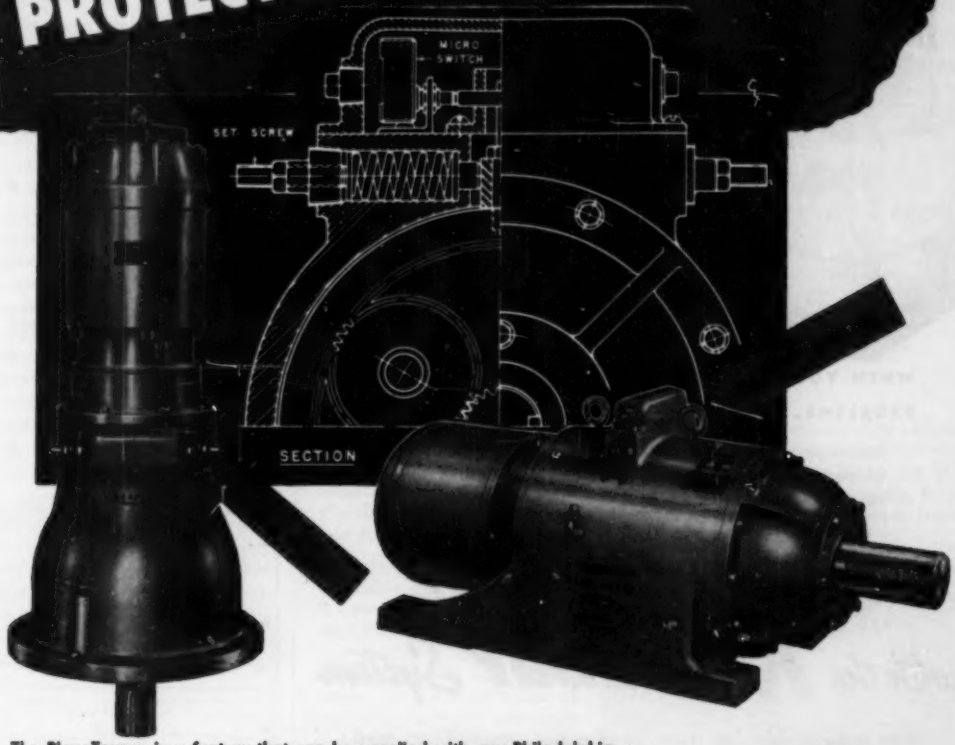
Instant PROTECTION Against overload



The PlaneTorque is a feature that can be supplied with any Philadelphia MotoReduceR *(combined motor and speed reducer)* or Philadelphia Planetary Reducer to protect both the driven machinery and the drive unit from dangerous overloads.

By direct mechanical action of the overload, motor current is *automatically and instantly cut off* when a pre-determined limit is reached. This action is quicker than electrical thermal relays provide. (With fuse protection only, fuses must be selected to carry the starting current of the motor; therefore, protection during running period is *not adequate*.)

The PlaneTorque can be cut-out during the starting period by merely holding down the starting button, but will become operative during running period when button is released. To re-start the PlaneTorque MotoReduceR after overload cut-off, *only removal of excessive load is necessary . . . a big time-saving feature.*

For applications such as stoker drives, conveyor drives, mixers, agitators, roll drives, etc. . . . investigate the PlaneTorque MotoReduceR.

Send for Catalog MR-49, and please use your Business Letterhead when writing.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
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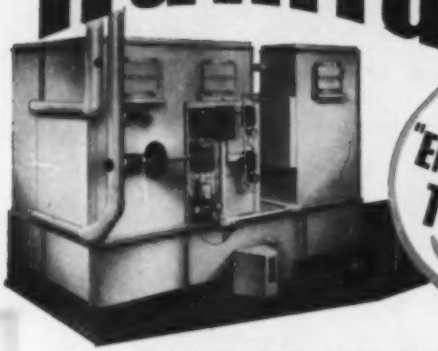
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Humidity



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WHEN YOU ARE CONFRONTED WITH ATMOSPHERE PROBLEMS...THINK OF HUMIDITY CONDITIONING

Believe us! ... humidity can play havoc with quality control and production schedules. We have hundreds of case histories from the processing industries where...

"Humidity Engineering" with the Kathabar System

was responsible for new production possibilities and greater operating efficiency. Don't overlook humidity ... one of the basic factors in air conditioning.

Surface Combustion Corporation has pioneered in "Humidity Engineering". Basic application data, accumulated during many years of research and field operation of the Kathabar System of Humidity Conditioning, are available to you. Why not take advantage of this knowledge.

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Please add my name to receive the "HUMIDITY ENGINEER"

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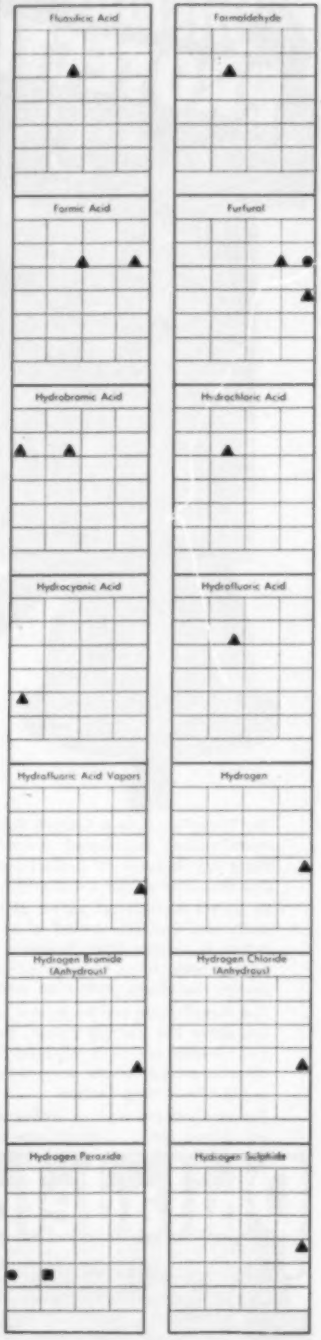
CORROSION FORUM, *cont. . .*

Key to charts is on p. 270



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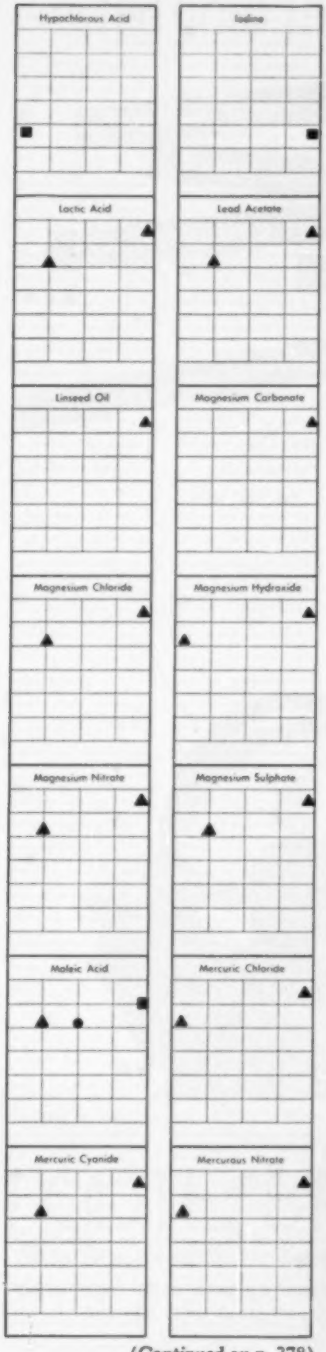


(Continued on p. 278)

find PLATECOILS more profitable to use

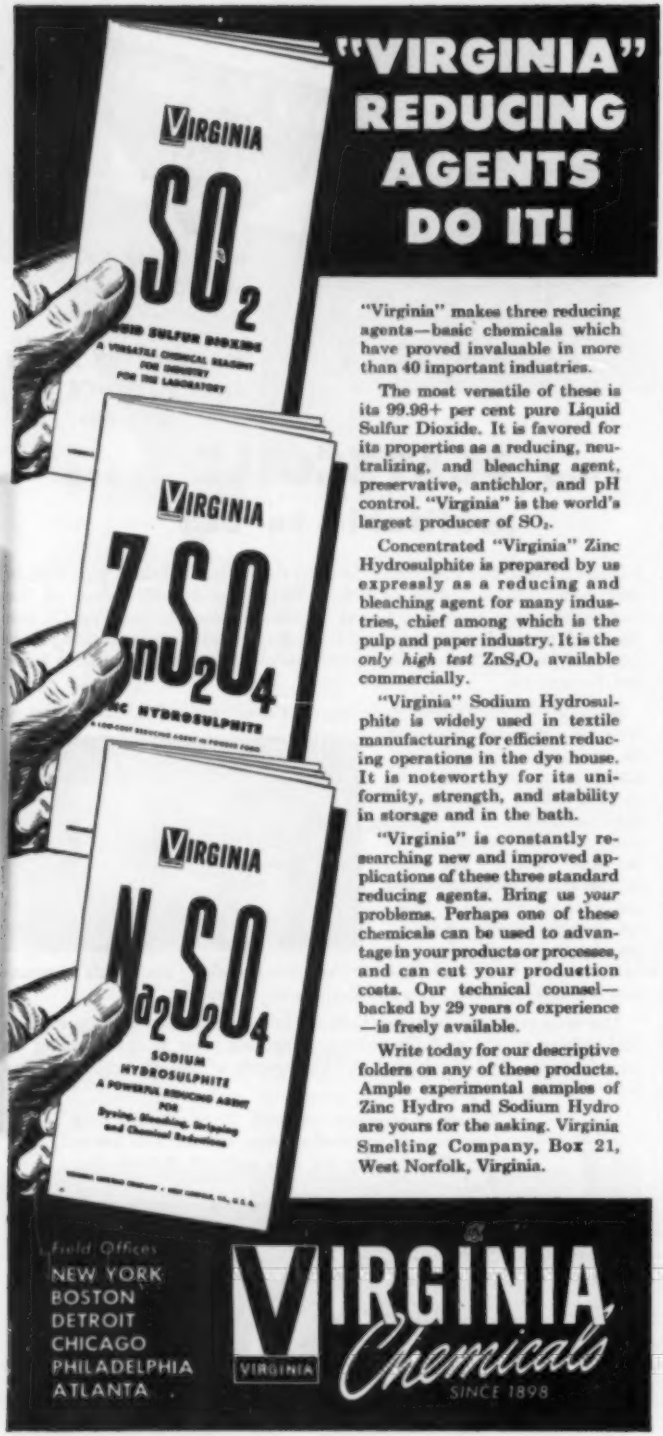
REPLACES PIPE COILS

It is less costly to buy and install Platecoils than it is to fabricate pipe coils in their own plant according to Robert Dill, Plant Superintendent of the Newcomb-Detroit Company, Grand Rapids Division. In building the hot rinse tank pictured above they have realized many advantages resulting from the use of Platecoils both for themselves and their customer, Kalamazoo Stove and Furnace Co.

Starting with the original estimate, sales engineers find it much easier to determine the coil size from the convenient Platecoil chart. And Platecoils can be depended upon to deliver the amount of heat specified in their B.T.U. rating. In the construction of the tank, Platecoils are easier to handle and fabrication time and labor are reduced. A Platecoil with the equivalent B.T.U. capacity as pipecoil takes only half the space in the tank thus leaving greater working area. This is important also to Kalamazoo Stove and Furnace Co. as the user.

The extra tank capacity comes in handy in the use of the tank as part of an acid etching system used for pickling aluminum prior to spot welding on aircraft parts. And the higher B.T.U. capacity of the Platecoils provides faster heating and quicker starts.

Wherever pipecoils are used, Platecoils will heat faster, can be installed quicker, and will cost less to use. Write today for your copy of Bulletin No. P-61.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A VERSATILE CHEMICAL REAGENT FOR INDUSTRY AND THE LABORATORY
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Dyeing, Bleaching, Stripping and Chemical Reductions
"Virginia" makes three reducing agents—basic chemicals which have proved invaluable in more than 40 important industries.
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Concentrated "Virginia" Zinc Hydrosulphite is prepared by us expressly as a reducing and bleaching agent for many industries, chief among which is the pulp and paper industry. It is the only high test ZnS_2O_4 available commercially.
"Virginia" Sodium Hydrosulphite is widely used in textile manufacturing for efficient reducing operations in the dye house. It is noteworthy for its uniformity, strength, and stability in storage and in the bath.
"Virginia" is constantly researching new and improved applications of these three standard reducing agents. Bring us your problems. Perhaps one of these chemicals can be used to advantage in your products or processes, and can cut your production costs. Our technical counsel—backed by 29 years of experience—is freely available.
Write today for our descriptive folders on any of these products. Ample experimental samples of Zinc Hydro and Sodium Hydro are yours for the asking. Virginia Smelting Company, Box 21, West Norfolk, Virginia.
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VIRGINIA Chemicals
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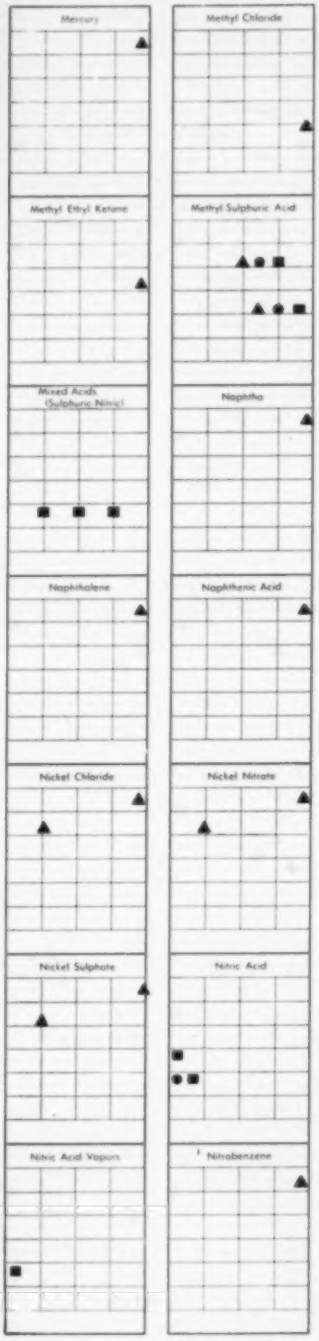
CORROSION FORUM, cont. . .

Key to charts is on p. 270



(Continued on p. 280)

the drive that has everything

compactness

large load capacity

low original cost

low operating cost

delivery out of stock

modern design

high quality precision gearing

Foote Bros. Line-O-Power Enclosed Gear Drives offer industry compact, straight-line units with efficiencies of 96% or higher.

Duti-Rated high hardness precision gears are assembled into streamlined housings of rugged cast iron.

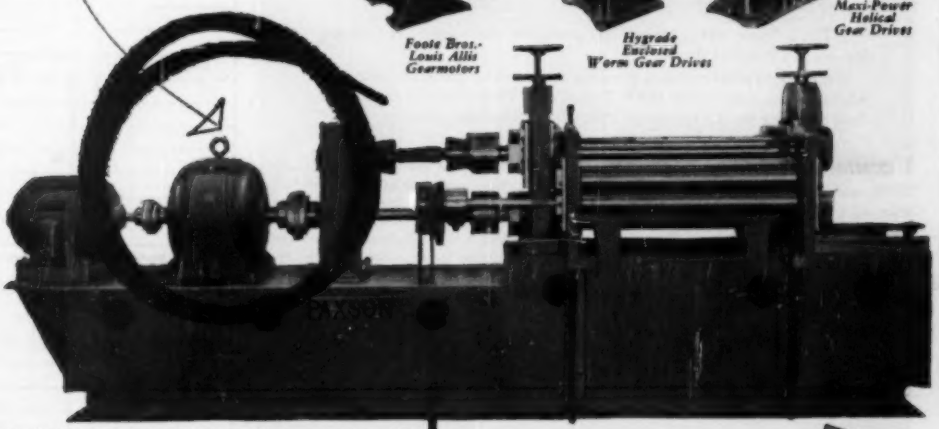
Economical in original cost because the latest, most accurate high production machine tools assure rapid production with exceptional accuracy for long wear life. Economical to operate because simplified construction, minimum number of moving parts, direct splash lubrication, quality workmanship all hold maintenance to a minimum.

Line-O-Power Drives are available for delivery from stock in double or triple reductions for capacities from 1 to 200 h.p., with ratios from 5 to 1 up to 238 to 1

Foote Bros.-Louis Allis Gearmotors

Hygrade Enclosed Worm Gear Drives

Maxi-Power Helical Gear Drives



Standard 36-inch slitter, manufactured by Paxson Machine Co., Salem, Ohio

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
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Chicago 9, Illinois

Foote Bros. Gear and Machine Corporation
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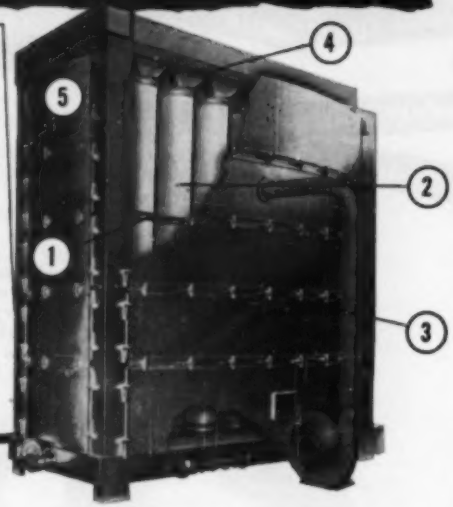
City..... **Zone**..... **State**.....

ABSOLUTE RECOVERY OF THE FINEST DUST PARTICLES

DAY TYPE "AC" DUST FILTER

- 99.998% COLLECTION EFFICIENCY
- NO CLEANING SHUTDOWNS
- HIGH AIR TO CLOTH RATIOS
- SPECIAL FELT FILTER CLOTH



Licensed by M. J. Marsey, Jr.

The DAY Type "AC" Dust Filter provides more efficient filtering for many chemical dusts.

Here are several reasons for this outstanding performance, and why you can rely on the DAY Type "AC" Dust Filter to meet your dust filtering problems more efficiently and economically:

1 CONTINUOUS-AUTOMATIC OPERATION: reverse jet rings travel slowly up and down the tubes cleaning them continuously with a maximum cloth area loss of only 1¾% at any time. This eliminates cleaning shutdowns and provides continuous, automatic operation with constant air volume.

2 SPECIAL FELT FILTER CLOTH: the gentle, yet positive reverse jet cleaning action permits the use of this high grade wool filtering fabric which collects even the finest dust particles. (Actual tests have shown up to 99.998% collection efficiencies.) Also, the use of this type of cloth allows higher air-to-cloth ratios of 10, 15 or even 20 to 1 with uniform back pressures.

3 OUTSTANDING ADAPTABILITY: units can be furnished in multiples of 4 tubes; sectionalized steel panel housings (see illustration) for filters requiring vacuum or outdoor installations; quick opening clamps simplify erection and permit removal of sections for easy access to filter. (The DAY Type "AC" Dust Filter can be supplied without housing where housing is not essential.)

4 NO DUST CATCHING LEDGES: DAY Type "AC" Filters with a pattern of square-to-round inlet fittings, have no flat surfaces where dust can accumulate and become contaminated.

5 SEPARATED DUST STREAMS: one DAY Type "AC" Dust Filter is able to handle as many as four different product streams simultaneously, without mixing.

WRITE-TO-DAY FOR BULLETIN 491

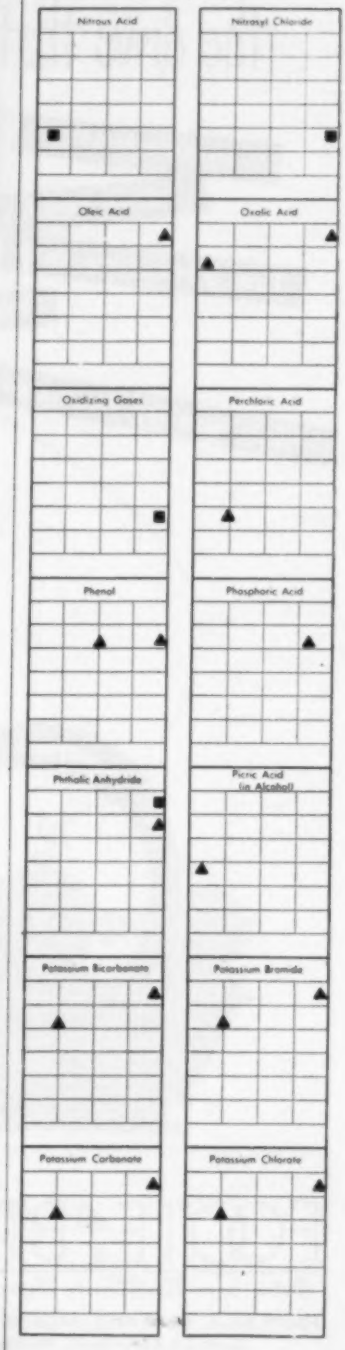
SINCE 1881

The **DAY** *Company*

856 3rd Ave. N. E., Minneapolis 13, Minn.
IN CANADA: P. O. Box 70N, Ft. William, Ontario
Branch Plants in Ft. Worth, Buffalo and Welland, Ontario

CORROSION FORUM, cont. . .

Key to charts is on p. 270



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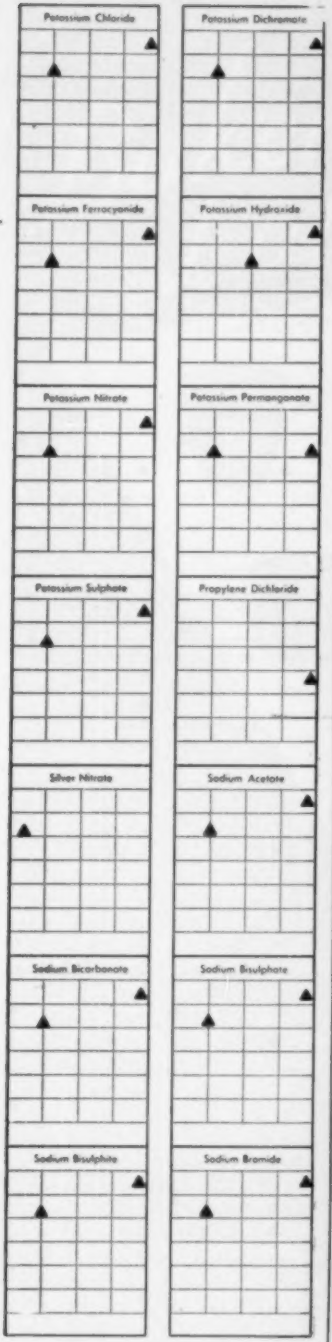
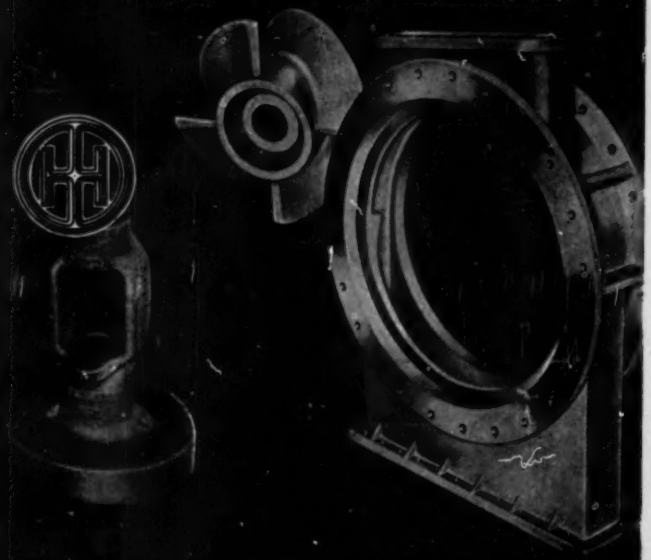


(Continued on p. 282)

made to withstand CORROSIVE action...

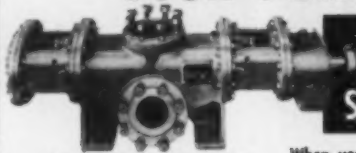
FAHRITE is made in a variety of grades. So, it is possible to get the exact grade to meet most individual conditions of corrosive agent, temperature and velocity. Let our engineering and metallurgical departments help solve your corrosion problems.

FAHRITE
STAINLESS STEEL CASTINGS



THE OHIO STEEL FOUNDRY CO.
SPRINGFIELD, OHIO • Plants at Springfield and Lima, Ohio

DOUBLE THE VALUE OF YOUR PUMP DOLLARS!



Specify *Sier-Bath* SCREW PUMPS

9 Pump Shown: new External Gear & Bearing Bracket Type for non-lubricating fluids, semi-fluids. Capacities 5 - 700 GPM; Discharge 1000 PSI for viscous liquids; 500 PSI for water.

When you choose a Sier-Bath Screw Pump your total investment is about the same—but you get a pump worth *twice as much:*

Investment "A"	TYPICAL CHOICE	*Investment "B"*
Cam, Lobe, Vane or Gear Pump ..... $ 770.00	Sier-Bath Screw Pump $1570.00
Low Speed Motor (or high speed motor plus reduction gearing) 2580.00	High Speed Motor 1860.00
TOTAL $3350.00	TOTAL $3430.00

Sier-Bath Screw Pumps are more dependable, need less maintenance, and last longer than the types listed in "A". Because their *axial flow* allows low liquid velocities with higher RPM, they use less expensive (and easier to get) high speed motors. As these motors provide service equal to that of low speed motors—and as Sier-Bath Screw Pumps provide *superior* service—"B" is the right choice.

For further information, see your local Sier-Bath Representative, or write to

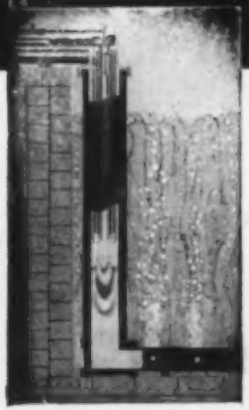
Sier-Bath GEAR and PUMP CO., Inc.

9259 HUDSON BLVD., NORTH BERGEN, N. J.

Also Manufacturers of Gearox Pumps, Precision Gears and Flexible Gear Couplings

Submerged Combustion

DIRECT FIRED GAS BURNERS



Exposed view Submerged Combustion Burner as now used to concentrate calcium chloride solution and ferric chloride.

A NEW METHOD FOR

HEATING and EVAPORATING

CORROSIVE AND NON-CORROSIVE LIQUIDS

★ Flame burns below surface, bringing liquid quickly to heat.

★ Hot exhaust gases forced through liquid carry away moisture.

★ Provides rapid evaporation and concentration of acids, salt solutions, suspensions. Also adapted to heating water and solutions.

★ Installed in any type tank. No boiler room required. Use any type gas—natural or manufactured. Automatic in operation.

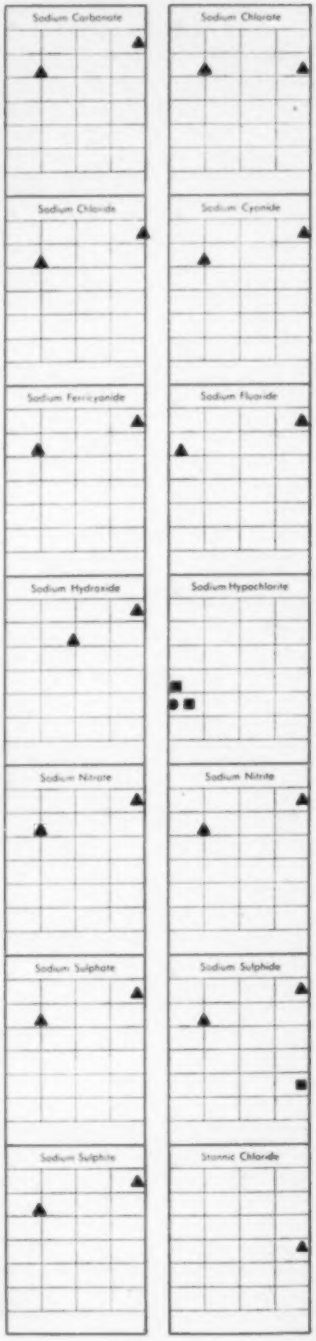
Free *Send for descriptive circular No. 52 and details*

SUBMERGED COMBUSTION CO.

OF AMERICA, INC.

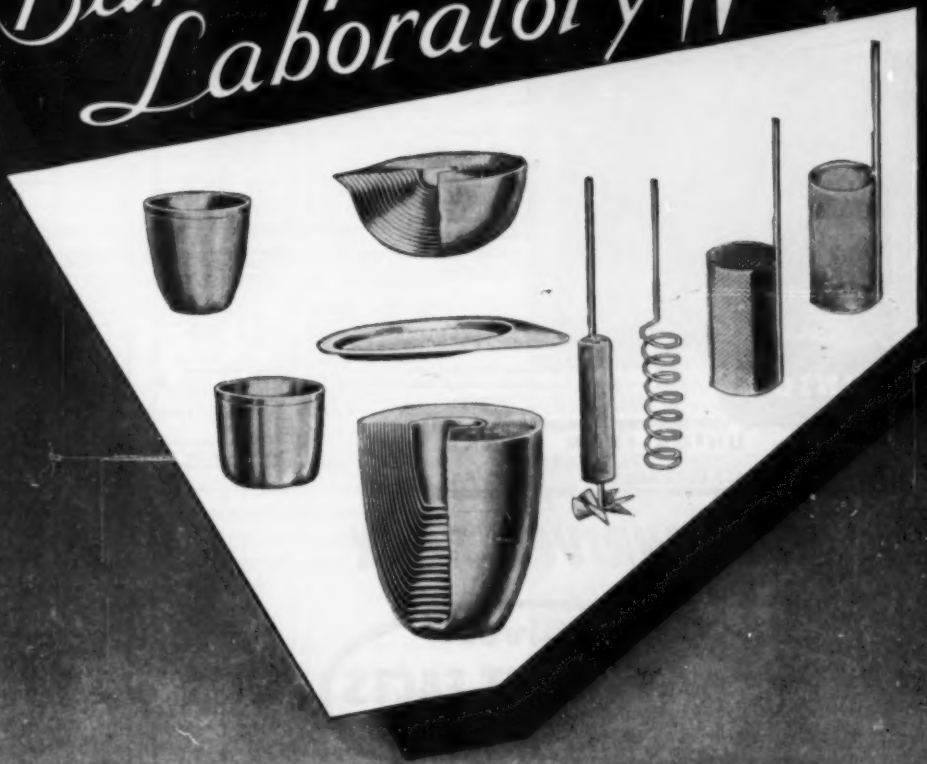
759 LOGAN STREET HAMMOND IND

Key to charts is on p. 270



(*Continued on p. 284*)

Baker Platinum Laboratory Ware



Production of platinum laboratory ware has been a specialty of ours for almost three-quarters of a century, and we have devoted a great deal of research and experiment to improving it.

This work has been aided greatly by the fact that we maintain and operate large scientific laboratories and use our own platinum ware in them.

Thus, the ware is subjected to day in, day out tests through use, and practical experience has brought about a number of improvements, among which are:

Improvements in metallurgical processes which have increased its useful life — development of the platinum-rhodium alloy which is now so widely used — design changes like the reinforced rim on crucibles and dishes — development of the low form crucible — improvements in the design of platinum electrodes.

You run no risk in making Baker Platinum Laboratory Ware standard equipment.

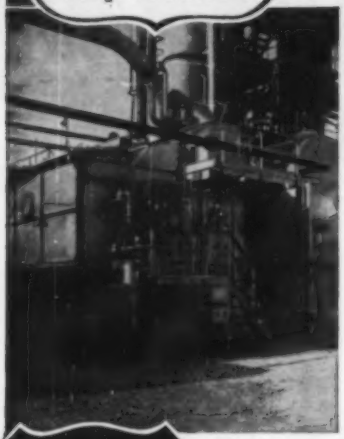
BAKER & CO., INC.

113 Astor St., Newark 5, N. J.

NEW YORK SAN FRANCISCO CHICAGO

UNION
Dowtherm Vaporizers

At
THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION



THIS 11,000,000 B.T.U. Hr. Union Outdoor Vaporizer is providing process heat for The Barrett Division, Allied Chemical and Dye Corporation, Ironton, Ohio.

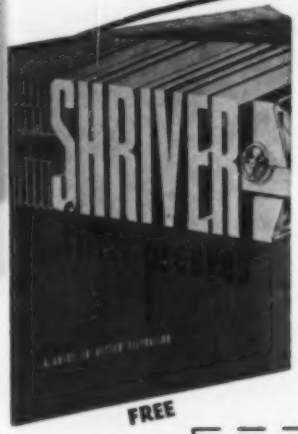
Union Dowtherm Vaporizers are built 250,000 B.T.U. Hr. to 30,000,000 B.T.U. Hr. at 700°F capacity, to applicable Construction Codes. They are designed for fuel gas or oil firing, also for the use of special fuels.

UNION

There are many practical reasons why Union Dowtherm Vaporizers result in profitable operation. Write for bulletin 124 which gives full information.

PROCESS EQUIPMENT
UNION IRON WORKS
Since 1890
650 CASCADE ST. ERIE, PA.

THIS NEW SHRIVER BOOK



FREE

Gives STRAIGHT FACTS on Filtration

The new Shriver book serves as a valuable guide in selecting the right type of filtration equipment for improving your process and product. It tells—

1. **How to Select Your Filter**
2. **How to Determine Type, Capacity, Construction**
3. **How to Determine Cost of Your Filter**
4. **Applications of Filters**

MAIL TODAY

T. SHRIVER & COMPANY, Inc., 802 Hamilton St., Harrison, N. J.
Send me New Shriver Filtration Book.

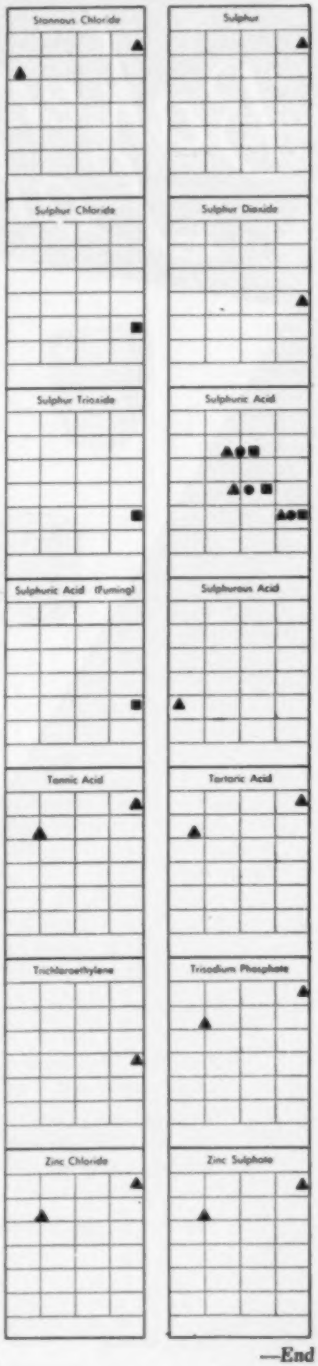
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Key to charts is on p. 270



—End

GAS provides the absolute flame control essential to FIBERGLAS* production at OWENS-CORNING FIBERGLAS CORPORATION

Fiberglas*, product of Owens-Corning Fiberglas Corporation in Kansas City, Kansas, is used commonly for insulating Gas ranges, Gas refrigerators, buildings, automobiles, and wrapping Gas pipe lines. Produced as wool, textile yarns, packs and mats, Fiberglas is made by processes dependent upon the precise control of critical temperatures assured by the Modern Fuel of Industry—GAS.

Fiberglas starts as molten glass, made in 100-ton Gas-fired melting tanks. The Gas burners are sealed to provide precise control of flame temperatures, flame length, and luminosity. A luminous Gas flame is desired because the radiation effect heats glass at the tank bottom.

Molten glass, accurately held at 2200° F. by readily controlled Gas burners, is run through metal bushings to form the filaments which constitute Fiberglas. Gas-fired drying and curing ovens further process this versatile material.

Gas is the Modern Fuel of Industry—easy to control for precise temperatures, and easy to integrate into any production line. Wherever you need industrial heat, you can rely on GAS. Get the facts from your Gas Company Representative today.

** T. M. Reg. U.S. Pat. Off.*

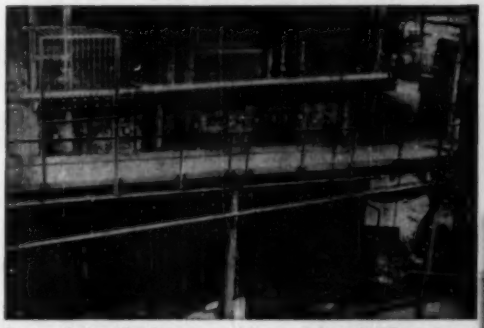
MORE AND MORE...

THE TREND IS TO GAS

FOR INDUSTRIAL PROCESSING

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK



One of the 100-ton continuous batch, Gas-fired melting tanks for making glass prior to manufacturing of Fiberglas products.

Two-zone, Gas-fired convection-type drying and curing oven, equipped with automatic temperature and safety controls.

Fiberglas Preformed Insulation, discharged from curing oven is cut to size at Owens-Corning's Kansas City Plant.

How Austenitic Nickel Cast Iron Can Serve As An Alternate for Caustic Manufacture

This currently available construction material may help salvage profits threatened by scarcity of materials and a potentially sluggish market.

H. O. TEEPLE, *International Nickel Co., New York, N. Y.*

There is currently under way a tremendous expansion of chlorine production in the United States, most of which will involve the use of either diaphragm or mercury cells. This means that for every ton of chlorine produced about 1.1 tons of caustic soda will also be produced. Now, even with the current acceleration of business due to the defense program, it appears doubtful that the chemical industry will be able to absorb this extra caustic production as readily as it will be able to absorb the additional chlorine capacity. In the months ahead many alkali producers will discover that their ability to sell caustic soda profitably will be based, to a large extent, upon product purity and low production cost. It is, therefore, reasonable to assume that production costs will be scrutinized very carefully and that much effort will be expended to reduce down-time as well as maintenance and repair costs, all of which would contribute toward reducing production costs for caustic alkalis.

In planning for this period, every effort will be made by the various alkali producers to install equipment during the caustic expansion program that will be capable of performing satisfactorily from a service life standpoint, bearing in mind, too, the quality of the end product. In obtaining suitable equipment today the average producer runs head-on into the government allocation program to conserve scarce metals, such as nickel, that have long been established as eminently suitable construction materials for caustic chemical plant equipment. Nickel is in short supply and all stocks are at present, and will be for the indefinite future, carefully controlled and allocated by the National Production Authority. This presents the caustic producer with a two-fold problem. On the one hand he is concerned with the maintenance of production, and on the other with the conservation of nickel. In this dual concept it is essential to consider factors other than the mere saving of the metal involved. These factors include maintenance and repair expense, loss of production and eventual replacement of the failed piece of equipment. Therefore, it appears reasonable to assume that the best way to conserve a critical metal, such as nickel, is to put the best material available in service. And this is a concept that meets the full approval of the National Production Authority.

Among the best materials available are the Ni-Resists, a series of austenitic nickel cast irons, that have been widely and successfully used by the chemical industry in the United States for the past two decades. Of the five basic types of Ni-Resist, Type 3 appears to be the best suited to meet the requirements of caustic service equipment.

THERMAL SHOCK

Let us first consider thermal coefficient of expansion, a matter of extreme importance in caustic production. Normal caustic plant practice very frequently involves the steaming out of caustic lines or flushing out with water, either one of which can cause a thermal shock of considerable proportion to the existing pumps and valves in the caustic line. Types 1 and 2 Ni-Resist have thermal coefficients of expansion of much higher order than that of Type 3, and the stresses that can be developed by thermal shock can be dangerously high in Types 1 and 2 but are of low magnitude in Type 3. It is generally hazardous, therefore, to specify either Type 1 or Type 2 for service wherein thermal shock is liable to occur.

Infrequency of thermal shock might discount this, but if it occurs at all it could prove too severe for either Type 1 or 2 Ni-Resist. The low coefficient of thermal expansion for Type 3 and its record of satisfactory performance in caustic service are certainly strong factors for the preference of this nickel alloyed cast iron.

STRENGTH AND TOUGHNESS

For caustic service demanding pumps and valves with higher strength and greater toughness than that available in conventional Type 3 Ni-Resist, Ductile Type 3 Ni-Resist is recommended. It has the same corrosion resistance as the conventional type, but its tensile strength values range from 60,000 to 65,000 psi. and its elongation is 10 to 20 percent.

CORROSION RESISTANCE

Types 1 and 2 Ni-Resist would not be expected to show useful corrosion rates in a caustic concentration ranging from 50 to 73 percent. For this concentration range, Type 3 is to be preferred. The corrosion resistance of Type 3 is favorable and would not be expected to contribute seriously to metal contamination of the caustic. As a means of evaluating the relative performance of the various Ni-Resists, we have included in the table corrosion rates for both pure nickel and unalloyed cast iron.

Considering its physical properties and corrosion resistance, Type 3 Ni-Resist is an optimum material of construction for pumps, valves and cast metal parts in caustic alkali service. Further, in view of the current conservation of nickel, Type 3 Ni-Resist would be a good alternate material to pure nickel for alkali concentrations from 50 to 73 percent.

In a good many cases, the over-all economics involved in the specification of Type 3 Ni-Resist as compared with those of pure nickel would undoubtedly be in favor of the Type 3 for caustic concentrations up to and including 70 percent. For handling caustic alkalis of greater than 73 percent concentration, pure nickel is still the most economical material of construction.

Composition of Ni-Resist

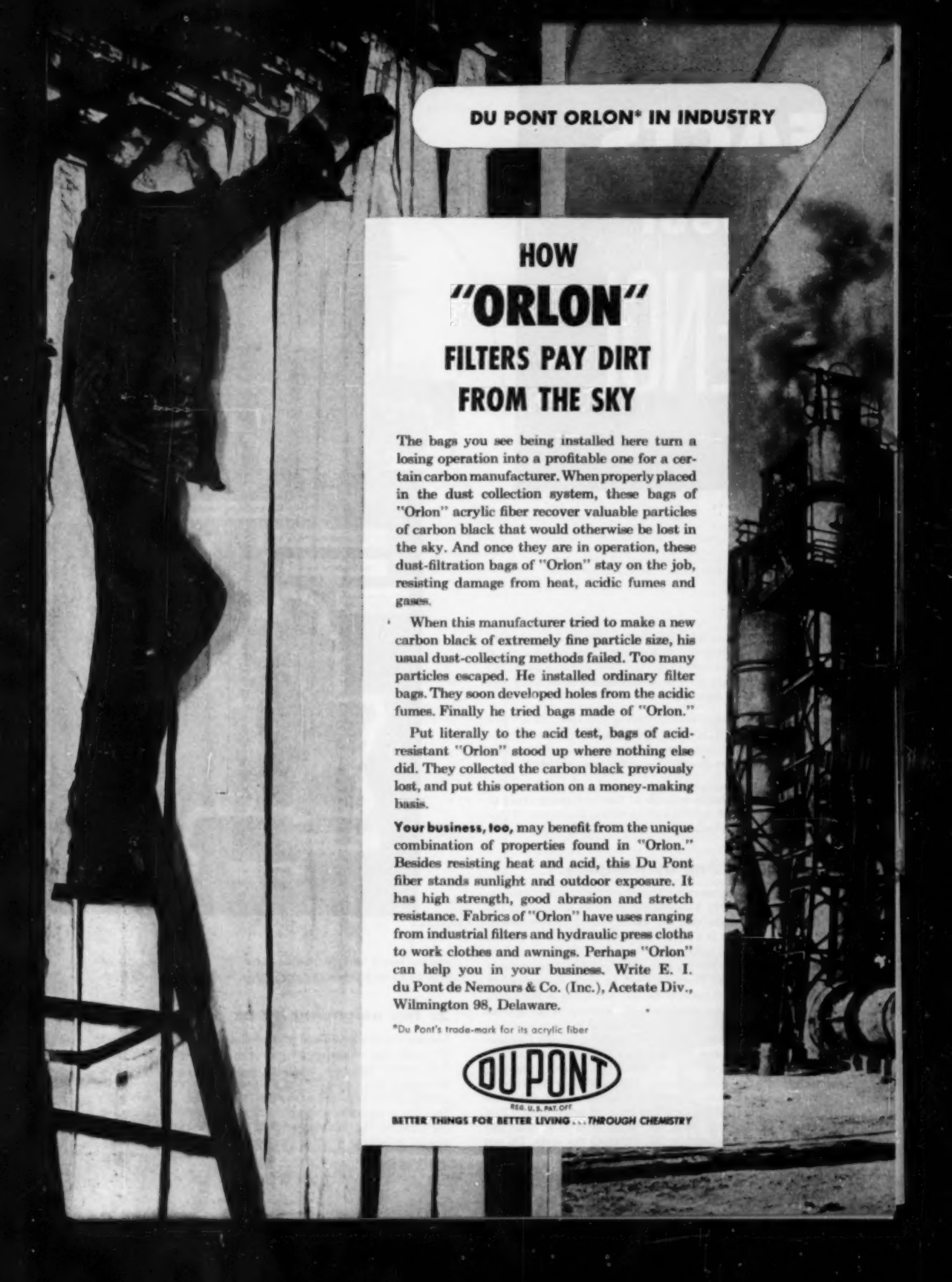
	Type 1	Type 2	Type 3
Total carbon	3.0 max.	3.0 max.	2.75 max.
Silicon	1.0–2.5	1.0–2.5	1.0–2.0
Manganese	1.0–1.5	0.8–1.5	0.4–0.8
Nickel	13.5–17.5	18.0–22.0	28.0–32.0
Copper	5.5–7.5	0.5 max.	0.5 max.
Chromium	1.75–2.5	1.75–2.0	2.5–3.5

Corrosion Rates

50–65% NaOH, 81 days at boiling.

Material	In. per yr
Type 1 Ni-Resist (15% nickel iron)	0.030
Type 2 Ni-Resist (20% nickel iron)	0.0035
Type 3 Ni-Resist (30% nickel iron)	0.0004
Nickel	0.0001
Cast iron	0.080

NOTE: *See Corrosion Forum Dec. 1949, Jan. and Feb. 1950 for suitability of other materials for use with caustic*—EDITOR.



DU PONT ORLON* IN INDUSTRY

HOW "ORLON" FILTERS PAY DIRT FROM THE SKY

The bags you see being installed here turn a losing operation into a profitable one for a certain carbon manufacturer. When properly placed in the dust collection system, these bags of "Orlon" acrylic fiber recover valuable particles of carbon black that would otherwise be lost in the sky. And once they are in operation, these dust-filtration bags of "Orlon" stay on the job, resisting damage from heat, acidic fumes and gases.

When this manufacturer tried to make a new carbon black of extremely fine particle size, his usual dust-collecting methods failed. Too many particles escaped. He installed ordinary filter bags. They soon developed holes from the acidic fumes. Finally he tried bags made of "Orlon."

Put literally to the acid test, bags of acid-resistant "Orlon" stood up where nothing else did. They collected the carbon black previously lost, and put this operation on a money-making basis.

Your business, too, may benefit from the unique combination of properties found in "Orlon." Besides resisting heat and acid, this Du Pont fiber stands sunlight and outdoor exposure. It has high strength, good abrasion and stretch resistance. Fabrics of "Orlon" have uses ranging from industrial filters and hydraulic press cloths to work clothes and awnings. Perhaps "Orlon" can help you in your business. Write E. I. du Pont de Nemours & Co. (Inc.), Acetate Div., Wilmington 98, Delaware.

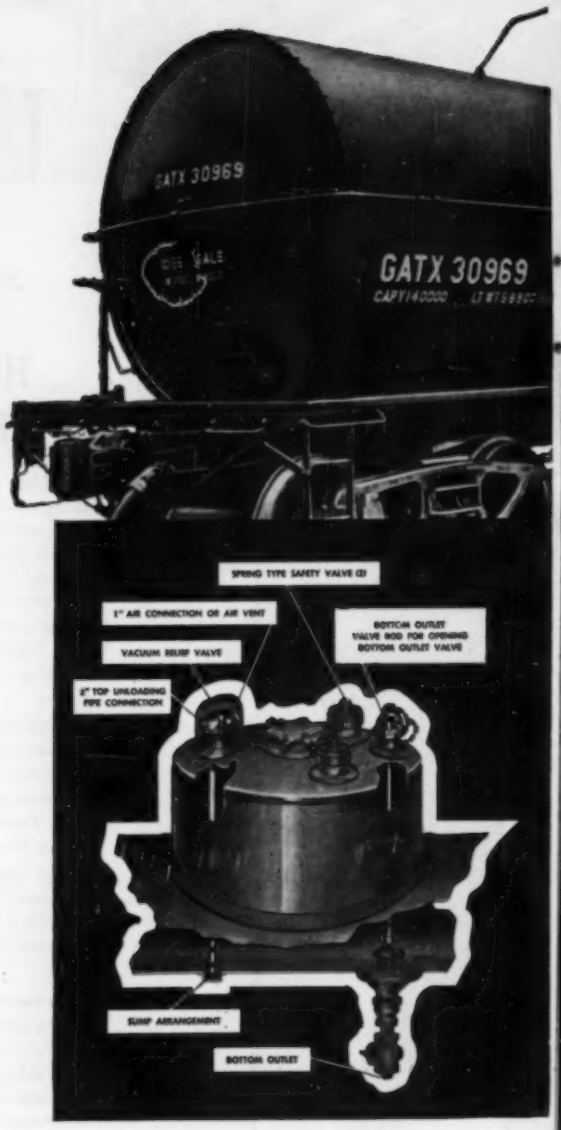
*Du Pont's trade-mark for its acrylic fiber

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

FACTS about PHENOL


GATX 30969
GATX 30969
SPRING TYPE SAFETY VALVE (2)
1" AIR CONNECTION OR AIR VENT
BOTTOM OUTLET VALVE ROD FOR OPENING BOTTOM OUTLET VALVE
VACUUM RELIEF VALVE
2" TOP UNLOADING PIPE CONNECTION
SUMP ARRANGEMENT
BOTTOM OUTLET

In times of shortages, additional effort should be expended to use materials efficiently and wisely. The importance of phenol in so many industries has led Dow to believe that the following information may be of assistance in helping you realize greater value from phenol.

Phenol is used in many manufacturing processes. It is used in the manufacture of: bonding agents for plywood—thermosetting type plastics—toluene—lubricating oils—lubricating oil additives—medicinals—dyes—perfumes—explosives.

Dow believes that complete and comprehensive information about phenol is extremely valuable at this time and is ready to help you further with advice and technical assistance. If you desire additional information, write to Dow, using coupon below.

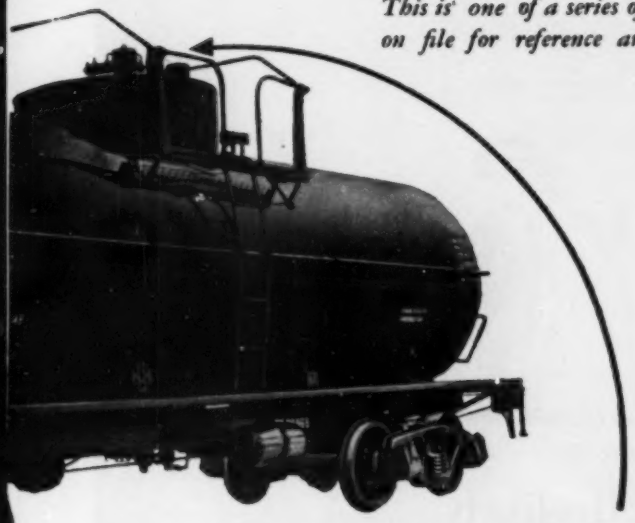
1. *Top unloading by pumping*

(1) Remove housing covering 1" air vent valve and 2" top unloading pipe valve. (2) Vent the car carefully by opening the 1" vent valve. To make sure that car is vented, open manhole cover bolts one turn at a time until cover is loose. If there is no pressure present, open manhole cover. (3) Connect low pressure steam to car heating coils. (4) Avoid heating contents of the car above 70°C. Phenol should be ready for unloading when the bottom and ends of the car are warm to the hand, providing the car is not insulated. (5) Remove the plug from the 2" top unloading valve and make sure that there is no unmelted phenol or foreign matter obstructing it. (6) Connect discharge side of pump to line running to the storage tank. Storage tank should be well vented. (7) Connect unloading line to the suction side of pump. The manhole cover may be left open for inspection. (8) Disconnect the piping after phenol has been pumped from car and wash off any phenol. Close all dome openings and blow out steam coils to prevent any residual condensate freezing and bursting the coils. Do not replace steam inlet and outlet caps. (9) Turn "Dangerous" placard to indicate empty car now is ready to return to Dow.

2. *Top unloading by air pressure*

Prepare the car for unloading by following items (1) through (5) under top unloading by pumping. Then: (6) Close manhole cover and bolt securely in place. (7) Connect the unloading line to the 2" top unloading pipe connection. Be certain the storage tank is vented. (8) Connect the air supply line (air pressure not to exceed 20 p.s.i.) to the 1" vent valve. (9) Observe the same procedure after the car is empty of phenol as before.

This is one of a series of Dow advertisements you may wish to keep on file for reference and information. Write Dow for reprints.



UNLOADING PHENOL TANK CARS

Be sure that tank cars stand on a level section of track in order to assure complete unloading of the car. Either of the following two methods may be used, but the first, *top unloading by pumping* is the safer, and the one recommended.

Physical Properties of Phenol

Phenol is a white crystalline chemical compound with an easily recognized aromatic odor.

Molecular Weight	94.11
Congealing or Freezing Point	40.9°C.
Boiling Point at 760 mm. Hg.	182.0°C.
Density	
Solid—at 25°C.	1.071 g./ml.
Liquid—at 50°C.	1.049 g./ml.
Critical Points	
Critical Temperature	419°C.
Critical Pressure	60.5 Atmospheres
Specific Heat	
Solid—at 4.0°C.	0.306
—at 22.7°C.	0.338
Liquid—70-74°C.	0.548
Viscosity	
Liquid at 45°C.	4.0 centipoises
Heat of Fusion	2690 cal./g. ml. 28.6 cal./g. 51.5 B.t.u./lb.
Heat of Vaporization at 182°C.	103.4 cal./g. 186.1 B.t.u./lb.
Heat of Combustion	732 K. cal./g. ml.
Flash Point	79.0°C.
Solubility	
Water in Phenol at 25°C.	71.28 g./100 g. solution
Phenol in Water at 25°C.	8.66 g./100 g. solution

Phenol is soluble in all proportions at room temperature in alcohol, benzene, monochlorobenzene and ether.

STORAGE

In solid state, phenol may be stored in the original container for considerable time without discoloration. Molten phenol, however, discolors when in contact with iron or copper-bearing metals. The higher the temperature, the more rapid the discoloration.

Storage tanks may be either welded or riveted construction. Tanks are usually equipped with steam coils for melting the phenol (temperatures should not exceed 70°C.) for transfer.

TRANSFER

When molten, phenol can be transferred like any other liquid, by gravity, pumping or blowing. Centrifugal and turbine type pumps are generally used and are satisfactory. A pump manufacturer can recommend suitable equipment when your requirements are known. Long fiber asbestos, lubricated with graphite, gives reasonable service when used as a pump packing. Pipe lines for handling phenol should be heated to maintain it in a liquid state. Steam-traced lines are usually used. Outside pipe lines in cold climates should be traced with ⅜" to ¾" steam lines dependent on the length of run and size of the line to be heated, with the tracer along the bottom of the pipe line, and both covered together with standard pipe covering. Short runs inside heated buildings should be traced on the under side of the pipe line, but need not be covered to keep the phenol above its melting point if more than 100 p.s.i. steam is used in the tracer line.

PRECAUTIONARY MEASURES

Phenol produces painful and dangerous burns of the skin in a very short time and death may result from external contact even on an area as small as the hand and forearm. It is classified by the Interstate Commerce Commission as a Class B poison and all containers bear the prescribed "DANGEROUS" placard or "POISON" label. Fumes are irritating to eyes and nose.

Persons engaged in handling phenol should always wear goggles or face shields and rubber gloves. Additional protection such as rubber boots, aprons and hoods may be advisable.

There should be adequate washing facilities immediately available. These facilities should include a shower bath or a water hose which gives a large stream of water under low pressure. For washing eyes, use a flow of water under low pressure.

In case phenol is spilled, it should be thoroughly washed away with water. Torches or heat sources other than low-pressure steam should never be used on phenol containers. No workman should ever be permitted to enter an empty tank or car which has been used for phenol until it has been thoroughly washed out, followed by a thorough steaming for approximately 12 hours.

In case of accidental contact: 1. Begin a thorough washing with large volumes of water. 2. Remove all contaminated clothing. 3. Call a physician.

THE DOW CHEMICAL COMPANY
Midland, Michigan

If you have a Phenol problem

write DOW for information and technical assistance

The Dow Chemical Company, Dept. GC-5A.
Midland, Michigan

☐ **Please send me literature about phenol.**
☐ **Please send _____ reprints of this advertisement.**

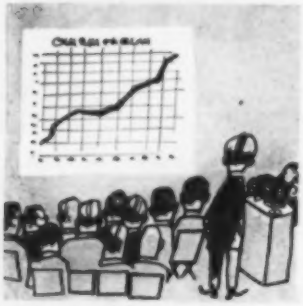
Name _____ Title _____

Company _____

Address _____

City _____ State _____

DOW
CHEMICALS
INDISPENSABLE TO INDUSTRY AND AGRICULTURE



PROJECTOR: Aid, not comedy prop.

MICROPHONE: How to use it to . . .

Present That Paper Effectively

In July our public speaking authority presented some tips on talking. This month he follows up with some practical tips on microphone technique and visual aids.

HERMAN W. SEINWERTH

Technical men have long known the value of using visual aids in their presentations. In fact, the heart of many technical papers is in the charts, graphs and tables that back up an author's proposals. All too often, though, their effectiveness is lessened or lost entirely because of improper usage. There are a few practical fundamentals which will be helpful in this respect, regardless of whether the audience consists of one or two persons or 1,000 persons.

Visual aids of the type we are discussing can be separated into four basic groups:

1. Projections.
2. Printed items, handouts and exhibits.
3. Charts, portfolios and blackboards.
4. Personal appearance, animation and gestures.

Let's take projections first. The rule here is a competent projectionist—and common sense. Most of us can remember more fouled-up situations with slide projectors than we can recall presentations that came off without a hitch.

The usual situation is something like a Max Sennett farce. Nobody has given a thought to the projector. When it's turned on the projection is too low. So the projector is propped up with books, bottles, cigar butts—anything at hand. Then it's too high. Meanwhile, somebody frantically hunts for the light switch, finds it and systematically turns every light in the house on and off—and amazingly out of time with the operator of the projector. When he yells "lights on," they go off. When he says "off" it's on.

About this time the makeship props for the projector crash to the floor and an expensive projector is just barely saved from instant death.

Then when finally everything is ready and a hush comes over the audience, the screen comes loose from its moorings, clackety-clacks around its spring for awhile, then clatters to the floor, nipping the bald headed gentleman in the first row, who, incidentally, lets out a bellow that breaks the spell of the mystic giving forth to the ladies club in the next parlor. At this point, the speaker might as well say "nuts," or words to that effect while he heads for home or the nearest bar. The man who will be able to concentrate on Reynolds numbers or logarithmic curves will not be in his audience.

It's fine to be a clown when you mean to be one, but it's sort of pathetic to be the scapegoat in a milieu of unintentional slapstick.

It's really not hard to avoid this sort of thing. Impress your meeting chairman or arrangements committee with the rules:

1. A competent projectionist.
2. Equipment set up early and tried out beforehand.

If it is impossible to set up the projector before your talk, have someone call an intermission to allow time for changing the seating arrangements, setting up the projector and making a "dry run." Never, never, never wait until you have been introduced to begin worrying about the projector.

Any speaker has a right to expect reasonable arrangements. If they are denied him, without good cause, he should refuse to speak.

PRINTED ITEMS, HANDOUTS, EXHIBITS

Ordinarily, it is never desirable to distribute samples or reading material to the audience before or during your talk. The reason is obvious. You cannot secure undivided attention if individuals in the audience are reading or otherwise examining an item instead of looking at you. If you have some handout materials, it is better to distribute these after your talk.

When using an exhibit always hold it high so that everyone can see it. If the item is rather small, walk closer to the group and even down the aisle if necessary. Remember that "nearsighted" man in the last row. Don't pick up or refer to the exhibit in any manner until you are ready to use it. When finished, set it aside promptly. Resist the normal temptation to handle and play with the item.

As you direct the attention of the audience to your exhibit, maintain eye contact with them. (By "contact" we mean looking at the entire group just as you would if speaking to an individual.) Remember that the exhibit has been prepared for the audience. You should glance at it only as often as is necessary.

CHARTS, PORTFOLIOS, BLACKBOARDS

Charts and portfolios must be placed so that they are not only easily seen by all of the audience but also can be handled and utilized conveniently by the speaker. Again, the speaker should face the audience and guard against turning away from them. Do not lean on the easel or nervously finger the sheets.

HERMAN W. SEINWERTH *is manager of Industrial Relations for the A. C. Lawrence Leather Co. His July article "Don't Pass Up That Chance to Talk," was so well received that we asked him back for a follow-up.*

You can't make gloves out of 6-inch lead

Yet that's the type of protection you need to handle radioactive materials. Greer solves the problem with "mechanical hands" which do the work while the operator stays safe in a protected area.

Greer has developed materials handling equipment which rivals the dexterity and versatility of the human hand. Complete laboratory experiments can be carried on remotely, and objects weighing from a fraction of an ounce to 250 lbs. are moved up, down, sideways, and pinpointed upon any given working area.

Materials handling is just one example of Greer's many interests. A staff of creative engineers is accustomed to dealing with out-of-ordinary problems. Each man has a wide general engineering knowledge and experience, and most are specialists within specific fields.

This hard-to-find experience is at your service. Please feel free to call on us at any time. If your problems seem out of our line, we will be happy to direct you to the right place. Write on your letterhead or call. There is no cost or obligation.

GREER

RESEARCH & DEVELOPMENT

GREER HYDRAULICS INC. · 454 EIGHTEENTH STREET · BROOKLYN 15, NEW YORK

EVAPORATIVE COOLING WITH NATIONAL CAST IRON SECTIONS *licks a tough problem*

FOR MARION MANUFACTURING CORPORATION INDIANAPOLIS, INDIANA

View of Marion Manufacturing Corporation's Evaporative Sulfuric Acid Coolers, one for drying tower, one for absorber tower acid, each consisting of 15 stacks of 18 type AX National Sections.

Lowering of the water table in the area caused a sharp increase in hardness in the well water used for cooling on Marion Manufacturing Corporation's contact sulfuric acid plant in Indianapolis. As a result, heavy scale formation was building up on the outside of the coolers used for the absorber tower and drying tower acid (98% H_2SO_4). This scale formation on the well water cooled units decreased efficiency and caused high maintenance expense.

The problem was solved at minimum expense by a new method of operating sprayed type National Sections as evaporative coolers. Instead of running the coolers on raw well water, a closed water system was developed, using treated city water in a recirculating system, the cooling on the sections being done by evaporation rather than through sensible heat pickup by the water. The National Section Coolers in effect act as their own cooling towers.

The economies of using an evaporative cooler engineered by National Radiator are considerable:

Low First Cost—Not much more than a cooler of comparable capacity utilizing raw water. No expensive cooling tower to buy.

Low Operating Cost—No well pump minimum disposal costs and problems. Make-up water a small fraction of usual amount circulated; treatment cost very moderate.

Low Maintenance Cost—No manual cleaning of the water side of the coolers; no down time for this periodic operation.

Greater Cooling Efficiency—Freedom from heavy outside fouling, consequently more uniform results. Designed for worst summer days; in winter can be run almost dry.

Conservation of Water—Vital in many localities.

Let National Radiator Company's heat transfer specialists consult with you on your particular cooling and condensing problems, and investigate the possibility of solving them with National Sections.

Heat Transfer Division

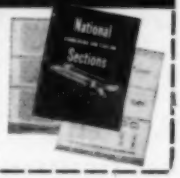
NRC THE NATIONAL RADIATOR COMPANY
JOHNSTOWN, PENNSYLVANIA

SEND COUPON

The National Radiator Co., Heat Transfer Division, CE
Johnstown, Pennsylvania

Please send Technical Manual HT-20 on National Condensing and Cooling Sections.

Name_____
Firm_____
Address_____ City_____ Zone_____ State_____



If you are using a pointer, do not pick it up until you are ready for it. Occasionally your general comments between the pages of the portfolio may be lengthy. If so, it is better to lay the pointer aside than to continue holding it because you will probably begin to play with it and thus distract the attention of the group.

It is helpful to be sufficiently familiar with the copy on each chart or portfolio sheet so that you do not have to read the material. This is another instance where we wish to maintain contact with the audience. There is the added disadvantage that if the audience is somewhat large or the acoustics poor, your voice will not be heard distinctly unless you are facing the group.

Chart material of this type is effective only when the print size is such that all persons in the audience can read it. It is well to bear this in mind when preparing your charts.

Blackboards can be used to good advantage when illustrating a talk. It is important not to turn your back to the audience to write on the blackboard while you are talking. Finish your comment, then turn to the blackboard and write. If there is much writing to be done, write part of it, re-establish contact with the audience by a comment or two and then resume writing. Of course, it follows that your writing must be easy to see.

PERSONAL ANIMATION AND GESTURES

Never forget that you are a mighty important exhibit yourself. Your personal appearance, neatness, posture, countenance, and attitude all weigh heavily with the audience. You must indicate by your countenance and actions that you are interested, sincere, and enthusiastic. Remember that enthusiasm is contagious. Give the audience a chance to catch it. Smile! Don't be serious! Be friendly!

If you use your fingers for enumerating, such as—first, second, third, etc., be sure that you hold your hand high enough so that all can see what you are doing. By the same token be positive that the number of fingers held up agrees with the enumeration. More than once, a speaker has been guilty of holding up two fingers while he was saying, "My third point . . ."

By way of summation, these five rules apply generally to all visual aids:

1. Have your projector set up before your talk and operated by someone who has been coached in its operation.

2. Plan your presentation and conduct it so that the attention of your audience is directed to only one thing at a time. Do not: Distribute materials before or during the talk. Dis-

PRODUCT CONTROL THROUGH *INFRARED ANALYSIS*

Number 4 *of a Series of Data Sheets for Better Process Control from The Perkin-Elmer Corporation, Manufacturers of Infrared Spectrometers, Flame Photometers and Electro-optical Instruments.*

PROBLEM:

Detection of gamma isomer for quality control of technical benzene hexachloride and lindane.

PLANT:

Hooker Electrochemical Company, Niagara Falls, N.Y.

SOLUTION:

Infrared analysis. For routine determinations, 2.0 g BHC is dissolved in 50 ml CS_2 and measured at the analytical wavelength for gamma. The working curve converts the optical density to the gamma content with accuracy of ±0.3% (Fig. 1). More elaborate procedures determine all five isomers in benzene hexachloride, or as little as 0.005% of any isomer other than gamma in lindane.

INSTRUMENTATION:

Standard Perkin-Elmer Spectrometer, Model 12-C, rock salt prism and cells.

DISCUSSION:

Of the five stereoisomers in BHC, only the gamma is an effective insecticide; hence, its proportion in BHC is essential for quality control. Routine infrared analysis takes 10 minutes; other methods take considerably longer. Hundreds of such control analyses are run every month by Hooker at a fraction of the cost by any other known method.

REFERENCE:

Ind. & Eng. Chem., Anal. Ed., 19, 779, 1947.

CONCLUSIONS:

Comparable analyses are in service on other Hooker products.

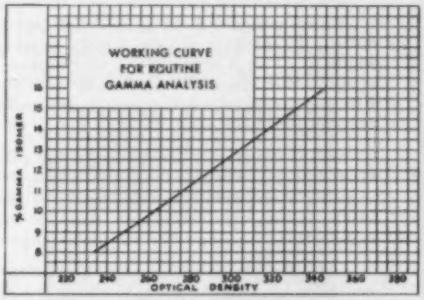


Fig. 1—Working curve yields gamma content from optical density.

Fig. 2—Perkin-Elmer Spectrometer speeds product control at Hooker Electrochemical Co.

Let us discuss your Product Control Problems with you.

THE PERKIN-ELMER CORPORATION

Optical designers and manufacturers of electro-optical instruments

NORWALK, CONNECTICUT

ARE YOU RECEIVING INSTRUMENT NEWS?

This 8-page quarterly brings you the latest developments in electro-optical instrumentation as well as their application to research and process control.

the Englander Company
SLEEP PRODUCTS

Selects Birmingham to Serve the Southeast

It's a short, fast haul from the Birmingham district to anywhere in the rapidly developing Southeast. This is reason No. 1 why so many diversified enterprises are establishing new plants, warehouses and sales offices at this crossroads of the Southeastern market.

Among recent new arrivals is the big plant of The Englander Company, Inc., manufacturers of a complete line of nationally advertised "sleep products," including the exclusive mattress of Goodyear's Airfoam with Englander's Red-Line foundation, innerspring mattresses, box springs, dual sleeping equipment.

I. M. Pink, president of The Englander Company, gave these reasons for placing the new plant in Birmingham:

"The South was a growing market for our nationally advertised products. Our expansion program called for another factory located in a strategic spot to serve the largest trading area. After a thorough survey, Birmingham was selected as another link in our chain of bedding plants from coast to coast. Right from the initial announcement of our plans to build in Birmingham, we have had an enthusiastic response from our trade."

Industries that sell in the Southeast have tremendous growth opportunities today in the Birmingham district—nationally recognized for skilled labor, ample power, abundant raw and semifinished materials, and superior transportation facilities.

* * * * * *

The Committee of 100 or any of the undersigned members of the Executive Committee will welcome the opportunity to give you confidential and specific data regarding the advantages of the Birmingham district for your plant, office or warehouse.

BIRMINGHAM COMMITTEE OF 100

1914 Sixth Ave., N., Birmingham, Ala.

Executive Committee

Gordon Persons, Governor, State of Alabama
Bradford C. Colcord, President, Wheelwright Iron Co.
John S. Coleman, President, Birmingham Trust National Bank
Donald Comer, Chairman of the Board, Avondale Mills
William P. Engel, President, Engel Companies
W. W. French, Jr., President, Moore-Handley Hardware Co.
Clarence B. Hanson, Jr., Publisher, The Birmingham News
W. H. Hoover, President, Employers Insurance Co. of Alabama
Mervyn H. Sterne, Sterne, Agee & Leach
Claude S. Lowson, President, Sloss-Sheffield Steel & Iron Co.
Thomas W. Martin, Chairman of the Board, Alabama Power Co.
J. C. Persons, President, First National Bank
O. W. Schaudacher, President, Levenson, Joseph & Loeb
A. V. Wiebel, President, Tennessee Coal, Iron & Railroad Co.

tract attention by toying or playing with objects. Lean all over the easel. Wave a pointer while you speak. Turn your back and continue talking.

3. Be sure that visual aids are so placed or exhibited that the audience can see them easily and clearly.

4. Maintain eye contact with the audience except when necessary to refer to the visual aids.

5. Remember that you are the Number One exhibit.

Occasional review and continued application of these tips really pays.

MICROPHONE TECHNIQUES

The ability to use a public-address system effectively is an advantage to anyone who speaks to large audiences. This ability is relatively easy to acquire if you will carefully review and practice these few suggestions:

1. Stand at ease, facing the microphone, with your feet about 12 inches apart.

2. Your distance from the microphone should correspond with its "pick up range," usually 6 to 10 inches. Determine this from the technician or by trial.

3. Adjust the stand so that the top of the microphone is just below your lips. The audience should be able to see your lips move. Once adjusted, do not touch the microphone and stand. Forget it.

4. See and talk to the audience over the top of the microphone. Do not talk into it nor look at it.

As you look at or "contact" different sections of the audience imagine that your head is held by a stiff wire running from your chin to the center of the microphone.

When you look toward the people on your right, shift your weight to your left foot, rotate the body slightly, and this imaginary wire will properly position your head so that you do see and talk over the mike.

To look at and contact the audience to your left, shift your weight to the right foot and again the make-believe wire keeps your head in the correct position.

5. Don't shout! Emphasis can be given by raising voice volume and stepping back slightly. A confidential effect is achieved by lowering voice volume and leaning forward.

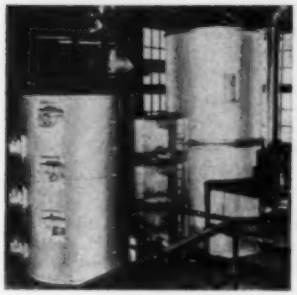
If you do not have a microphone, use a broomstick and practice these simple rules in front of a mirror. You will make the public address system your ally and no longer treacherous equipment which "acts up" just when you are trying to put over the most important part of your talk.

The author reserves all publication rights to the material in this article.

Nichols . . Laboratory and Pilot Plant Equipment

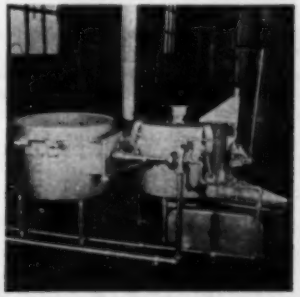
For the industrial or institutional laboratory requiring pilot plant facilities, Nichols Engineering services and several pilot plant size units are available, such as those for thermal processing, spray drying and classifying.

We are prepared to process materials in our laboratory and to design and supply equipment for installation in our clients laboratories. An experienced technical staff is available for operation.



36" Nichols Herreshoff Multiple Hearth Furnace

For investigations involving quantities of material up to about 250 lbs. per hour under conditions of continuous feed and discharge at temperatures up to 1800-1900°F. Heat supply by oil, fired in an extraneous combustion chamber. Hot combustion gases removed through breechings and outlets located at several hearths, with means for re-introduction if required. Capable of operation under either natural or induced draft.



18" Herreshoffing Unit →

For small-scale batch tests, up to 30 lbs., prior to advancement toward a more comprehensive program.

Portable Nerco-Niro Spray Dryer ←

Hot air supply by an electric heater or by mixing with hot combustion products from a gas burner. Capable of atomizer speeds up to 50,000 R.P.M. and temperatures to 575°F. For laboratories or small scale pilot plants.

12" x 48" DWIGHT-LLOYD Sintering Machine ↓

A pilot-size DWIGHT-LLOYD Sintering Machine for sintering small lots of materials and for test work in connection with the design of sintering plants. Capacity up to approximately 600 lbs. per hour.

1½" Vortrap Classifier ←.

For removing solids from slurries. 25 G.P.M. capacity.

Your inquiries are invited. Write us for further information.

Nichols Engineering & Research Corp.

70 PINE ST., NEW YORK 5, N. Y.

1920 N. Meridian St., Indianapolis 2, Ind. • 40 S. Los Robles Ave., Pasadena 1, Calif.

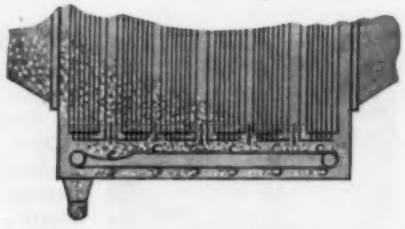
1477 Sherbrooke St. W., Montreal 25, Canada

Let's be practical about precipitators

1

This Koppers "packaged" mechanical or vacuum tube power pack is not restricted to an area near the precipitator. It can easily be installed in any convenient place in the plant. Result: Compact designs! More flexibility!

2



This Koppers exclusive—the bottom drag scraper—provides continuous dust removal. Cumbersome hoppers are eliminated and dust handling is simplified. Result: Lower operating costs! Less space requirement!

Here are two ways Koppers engineers simplify precipitator operation for you!

PERFORMANCE GUARANTEED!

Koppers engineers protect your investment in an electrostatic precipitator by guaranteeing both the recovery or gas-cleaning *efficiency* and the *residual content* left in the gas after cleaning. Koppers-Elex electrostatic precipitators are designed, engineered, fabricated, erected and guaranteed *under one contract* by Koppers Company, Inc.

IN ADDITION to high efficiency, Koppers concentrates on the practical aspects of electrostatic precipitator design. Shown above are just two of the many practical features which simplify operation.

Besides these compact power packs and the continuous dust removal features, Koppers-Elex electrostatic precipitators may be of the multiple-chamber type. This means one chamber may be shut down for inspection or maintenance without stopping the gas-cleaning action. The dirty gas is simply diverted through other chambers where cleaning continues.

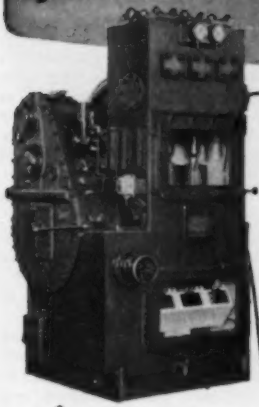
Because rapping is *sectionalized*, re-entrainment is minimized. And because successive collection fields can be separately *energized*, maximum voltage can be applied to each field—with higher gas-cleaning efficiency resulting. Pressure drops are negligible.

IF YOU HAVE A GAS-CLEANING PROBLEM, write and outline the details for us to review. There is no obligation. Just address your letter to: KOPPERS COMPANY, INC., *Precipitator Dept.*, 312 Scott Street, Baltimore 3, Maryland.

KOPPERS®

Koppers-Elex ELECTROSTATIC PRECIPITATORS

There's an ALDRICH Pump to meet your chemical pumping need...



APPLICATIONS

Among many liquids handled by Aldrich Pumps are: caustic solutions, fatty acids, nitric acid, acetic acid, aqua ammonia, anhydrous ammonia, as well as liquids encountered in the petroleum refining, petroleum chemical, and other industries.

Aldrich-Groff "POWR-SAVR" Controllable Capacity Pump.

For automatically controlled delivery

This calls for an *Aldrich-Groff "POWR-SAVR"*—a variable stroke triplex pump which controls delivery from 0 to 100% capacity at constant pump and motor speed. Control can be accomplished from any remote point, manually or automatically. Power consumption is almost directly proportional to demand. Units handle any free-flowing liquid at discharge pressures from 300 to 15,000 psi and are available in six sizes: from 2" to 6" stroke and from 5 to 125 bhp. Request Data Sheet 65.

For high pressure at small volume

Specify the *Aldrich-Lytle Hydro-Pneumatic Unit.* This pump is self-contained, uses normal plant air supply as the power medium, and provides high pressures (up to 20,000 psi) at small volume. Request Data Sheet 69A.

For medium to high pressure service

Here, several types of constant stroke pumps are available—depending upon the service involved. You may need the Inverted Vertical Triplex (Data Sheet 66), the Vertical Triplex (Data Sheet 26), or the Direct Flow Triplex or Multiplex Pump (Data Sheets 64, 64B).

From our experience in building pumps for the chemical industry, we can—from our engineering and service files—frequently make specific recommendations to meet your chemical pumping needs . . . whether your problem involves corrosion, high viscosity or high pressure.

Any or all of the above Data Sheets are available on request.

Aldrich Accumulators are also available to meet your displacement requirements. For information on hydro-pneumatic and weight-loaded types, request Data Sheets 29, 29A.

THE ALDRICH PUMP COMPANY

...Originators of the Direct Flow Pump

3 GORDON STREET • ALLENTOWN, PENNSYLVANIA

Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit
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Richmond, Va. • St. Louis • San Francisco • Seattle • Spokane, Wash. • Syracuse • Tulsa • Export Dept.: 751 Drexel Building, Phila. 6, Pa.

Names in the News Edited by Frances Arne

MAN OF THE MONTH: William I. Burt

AIChE's new president, B. F. Goodrich Chemical Co.'s vice president-manufacturing.

Nearly all of the present key production men in B. F. Goodrich Chemical came from the company's plant number 3 in Akron. Consequently these men could be called Burt-trained since this plant was headed by William I. Burt from 1927 to 1942. For any phase of the company's business, Burt feels that production experience is good training for young men.

Another proven theory of Burt's is that young men can shoulder responsibilities. During the war years he demonstrated this with such good results that today it is company policy.

William I. Burt was born 58 years ago in Granger, Ohio. He received his early education in Ohio and graduated in 1917 from Ohio State University with a B.S. degree in chemical engineering. After graduation, Burt worked as a chemist for several companies, was a member of the Chemical Warfare Service in 1918, sales engineer for the Bristol Co., chemical engineer for Dolomite Products and Republic Steel.

In 1927, Burt joined B. F. Goodrich in Akron, Ohio, as a research chemist and then became manager of the chemical manufacturing division. He was promoted to superintendent of production, chemical division, in 1942, then general manager of plants, chemical division, in 1943. At the formation of B. F. Goodrich Chemical Co. in 1945, he was named vice president-manufacturing.

Burt has traveled extensively for B. F. Goodrich Chemical Co. A few of the highlights are his trips to England in connection with the forming of British Geon, Ltd., to Japan when Japanese Geon, Inc., was established, and most recently to Sao Paulo, Brazil, where Geon do Brazil is under construction.

He is a counsellor to the American Institute of Engineering and has served in various offices at AIChE of which he has just been made president.

Relaxing at home is Burt's favorite hobby, although he is also a good amateur carpenter and has an elaborate home workshop. He and his wife enjoy gardening at the Burt home in Shaker Heights, Ohio. They have one daughter who is married and is living on the West Coast. Some day the Burts hope to retire to the South.

J. P. Moser. General manager, manufacturing division, Lever Bros. With Lever for 26 years most recently as manufacturing manager. New production manager: **G. G. Grant,** formerly western operations manager. New associate production manager: **J. W. Flynn,** formerly eastern operations manager.

Linus Pauling. First recipient of the Gilbert Newton Lewis Medal of the California section of ACS. Presented to North American chemists who have made significant contributions to the theoretical aspects of chemistry. Professor Pauling is chairman of the division of chemistry and chemical engineering, California Institute of Technology. Noted for his work on the nature of the chemical bond and the resonance theory of molecular structure.

J. Herbert Babcock. New member of the board of directors, Hooker Electrochemical Co., Niagara Falls, N. Y. Vice president in charge of development and research. Started with the company in 1916 as a research chemist. Some subsequent positions: manager of research, manager of development and research.

Bernard Lewis. Director of powder and explosives research and development, Ordnance Corps, Department of the Army. On one-year leave from his post as physical chemist with the U. S. Bureau of Mines. Studied at MIT, Harvard and Cambridge.

H. L. Barnebey. Has founded his own business, known as H. L. Barnebey, Chemical Processes, for the selection, evaluation and licensing of important processes. Formerly, head of the chemical plants division, Blaw-Knox.

Neal R. Amundson. Head of the department of chemical engineering, University of Minnesota. Has been acting as head for two years. Doctorate from the University of Minnesota.

Bernard C. Case. Manager of electrochemical development, Hanson-Van Winkle-Munning Co., Matawan, N. J. Formerly field engineer at the company's Detroit office.

William M. Creasy. In a dual role as Commanding General of Army Chemical Center, Md. and of the newly-formed research and engineering command. The brigadier general thus becomes responsible for all research and development for the Department of the Army in toxicological warfare. Formerly, chief of the Corps' research and engineering division.

W. M. Creasy

H. M. Black

Henry M. Black. Commanding General of the Materiel Command; responsible for the overall procurement, storage, and supply of all Chemical Corps items for the Department of Defense. Formerly, assistant chief chemical officer for materiel.

Jefferson Ethylene Glycol

A versatile industrial chemical

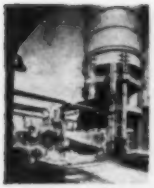
For use in the production of...

Antifreeze	Industrial Explosives
Cellophane	Synthetic Fibers
Alkyd Resins	Hydraulic Fluids

For these and many other uses the high purity and uniformity of Jefferson ethylene glycol meet the most exacting demands of experienced chemical manufacturers.

For information on price and availability write today to our Sales Division, Department G.

★ *National defense requirements have created emergency demands for Jefferson chemicals. Although our facilities are being expanded as rapidly as possible to cope with these requirements, many of our chemicals are currently in short supply. We nevertheless welcome your inquiries and will make every effort to serve you.*



Quicklime silo and lime slakers in ethylene oxide and glycol unit at Jefferson's Neches plant.

Jefferson Chemical Company, Inc.

711 FIFTH AVENUE, NEW YORK 22, N. Y.

ESSENTIAL CHEMICALS FROM HYDROCARBON SOURCES

ETHYLENE OXIDE
DIETHYLENE GLYCOL
ETHYLENE DICHLORIDE
ETHYLENE GLYCOL

Briefs

From recent literature

Heat for the machineless waving of hair is usually generated by bringing aqueous ethylene glycol into contact with potassium permanganate. It has been found that a longer-lasting, more even heat is developed if a polyoxyethylene ether of glucose or a similar sugar is added to the glycol solution. These mixtures are, of course, adaptable to other uses requiring chemical heating.

Stable suspensions of polymeric chlorotrifluoroethylene suitable for use in coating wires are formed by grinding the polymer in a micropulvizer and then milling the finely divided polymer in a ball mill with a solution of a monohydric alcohol in ethylene glycol. Uniform, flexible coatings having good electrical resistance are formed on wire by passing the wire through the suspension and then baking.

Water-soluble modifications of prolamins (particularly zein) are prepared by heating the prolamin with ethylene glycol in the presence of a strong base. The modified prolamin is useful in the preparation of inks, water dilutable paints, and molding compositions.

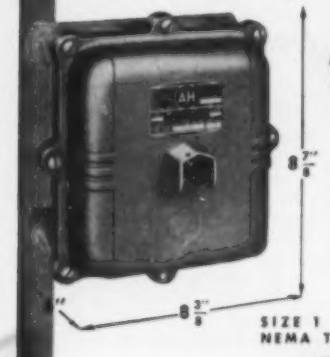
Polymeric esters of cyclohexadiene dicarboxylic acids and ethylene glycol are oils exhibiting the air oxidation–hardening properties of drying oils (e.g. linseed oil). The polymers are thermosetting and form hard coatings when heated to about 150°C. The hardening properties of the polymers are explained as being due to the variety of cross-linkages which may be formed under various conditions.

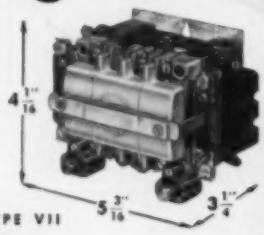
These developments are abstracted from recent publications or U. S. patents. They may suggest other applications of Jefferson Ethylene Glycol in your products or processes.

Outstanding Performance

WITH JUST

2/3 THE WEIGHT





ARROW AH HART

EXPLO-SAFE

MOTOR STARTERS

FOR ALL HAZARDOUS LOCATIONS

APPROVED BY UNDERWRITERS' LABORATORIES

Just 2/3 the weight means faster, easier installation with Arrow-Hart's new EXPLO-SAFE magnetic starters. Hanging requires less support giving new opportunities for more convenient layout. Size has been reduced by ⅓, too, allowing more compact control centers. Exclusive straight-thru front wiring means quicker, easier wiring and servicing. EXPLO-SAFE will provide better protection for all your hazardous location installations without the inconvenience of cumbersome, outmoded solenoid starters. The revolutionary "RA," Right Angle, balanced operating mechanism not only permits valuable savings in weight and size, but also assures outstanding performance and dependable, low maintenance operation. Remember — there's an EXPLO-SAFE starter for every installation. Starter and contactor sizes 0, 1, 2, 3, 4 are now available in NEMA Type VII (Explosive Gas), Type IX (Explosive Dust), and Type IV (Weatherproof).

HERE IS IMPORTANT INFORMATION

This illustrated booklet fully describes all the important operating advantages of the new EXPLO-SAFE motor starters. Complete with dimensional and rating data. It will be mailed without cost or obligation.

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INDUSTRIAL CONTROL DIVISION
3612 Hawthorn St., Hartford 6, Conn.

Please send me "EXPLO-SAFE" MOTOR STARTER folder.

YOUR NAME _____

POSITION _____

CO. NAME _____

CO. ADDRESS _____

CITY _____ ZONE _____ STATE _____

Elliott E. Geisinger. Vice president and general manager in charge of production and research, Pfaudler Co., Rochester, N. Y. Has been vice president in charge of the Rochester division. With company since 1918. Some previous assignments: technical advisor of subsidiary plant at Schwetzingen, Baden, Germany; in charge of the erection and initial operation of the British affiliate plant, Enamelled Metal Products Corp., in Leven, Fife, Scotland; vice president in charge of foreign plants.

E. E. Geisinger

R. C. Newton

Roy C. Newton. Winner of the 1952 medal of the Industrial Research Institute. Vice president in charge of research, Swift & Co. Joined Swift as a research chemist in 1924. Doctorate in chemistry from the University of Chicago.

E. A. Yaeger. Vice president, National Distillers Chemical Corp., New York.

Kenneth H. Klipstein. Assistant administrator, NPA, in charge of the Chemical, Rubber and Forest Products Bureau. Formerly director of the Chemical Division. On leave from his post as assistant general manager and head of the technical department, Calco Chemical Division, American Cyanamid. New deputy assistant administrator, Chemical, Rubber and Forest Products Bureau: **Lawrence W. Strattner.**

G. W. McCullough. Member of the Professional Engineers Conference Board for Industry just formed by the National Society of Professional Engineers to carry out an extensive research program into problems involved in engineering-management communication. Mr. McCullough is general manager and vice president, Phillips Chemical Co. Some other members of the conference board; **James F. Fairman,** vice president, Consolidated Edison; **Robert M. Gates,** president, Air-Preheater; **C. D. Blackwelder,** vice president in charge of engineering, Reynolds

Metals Co.; **Harry Darby,** president, Darby Corp.; **C. Y. Thomas,** vice president, Spencer Chemical.

Gordon H. Lovett. Project leader, process engineering department, Monsanto's Texas City plant. Formerly research chemical engineer in pilot plant and chemical engineering design and evaluation at the company's central research laboratories at Dayton. Joined Monsanto in 1946 as a research chemist at Dayton.

Melvin C. Molstad. Chairman, ACS division of industrial and engineering chemistry for 1952. Acting director of the department of chemical engineering, University of Pennsylvania; on the faculty since 1939. Previous positions: chemical engineer on the staff of the fixed nitrogen research laboratory, U. S. Dept. of Agriculture; on the faculty at Yale; chemical engineer, ammonia department, Du Pont. Studied at Carleton College, MIT, Yale.

Asger F. Langlykke. Chairman of the ACS division of agriculture and food chemistry for 1952. Director of research and development laboratories, E. R. Squibb & Sons. Some previous positions: research chemist, Hiram Walker & Sons; superintendent of a butyl alcohol plant operated by the Association Azucarera Cooperative Lafayette, Arroyo, Puerto Rico; acting head of the agricultural motor fuels division, Northern Regional Research Laboratory.

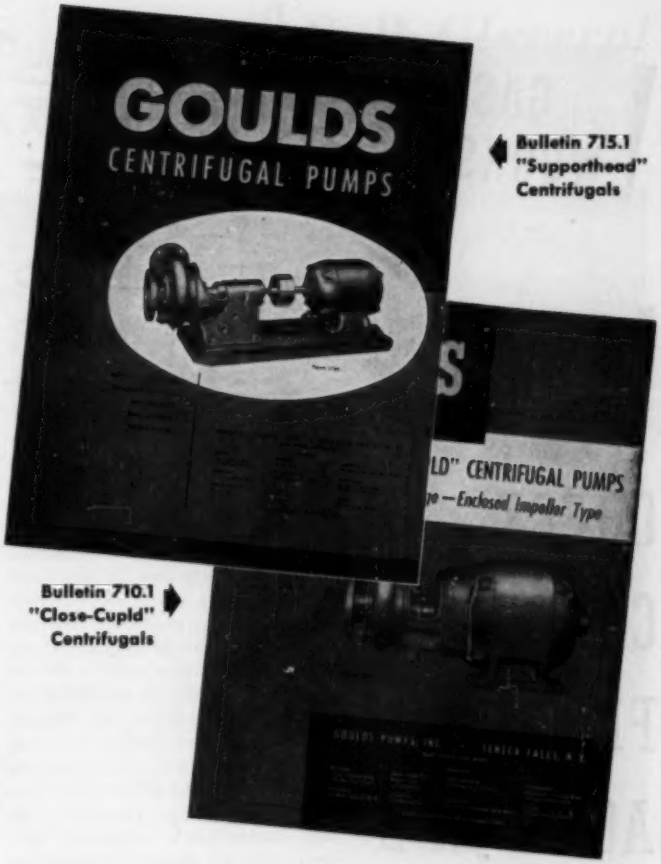
A. B. Callahan. Manager of the chlor-alkali department, chemical plants division, Blaw-Knox. Joined the company in 1944 as a project engineer.

A. B. Callahan

F. H. Edelman

F. H. Edelman. Chief chemist, Electronic Devices Co., New York. Formerly, chief product chemist, International Resistance Co., Philadelphia.

Donald W. Collier. Director of research, Thomas A. Edison, Inc., West Orange, N. J. Has been in charge of chemical research and



These new bulletins make it easier for you to select the right pump

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Another valuable feature of these bulletins is the parts chart. Using this you see exactly what parts are interchangeable for all size pumps and so can keep your spare parts investment to a minimum.

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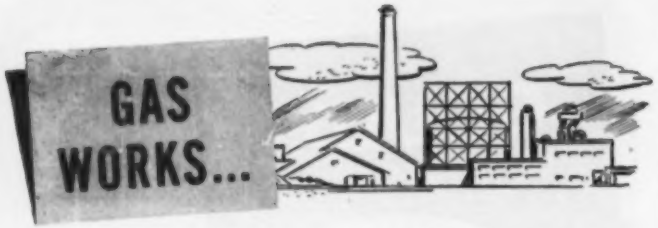

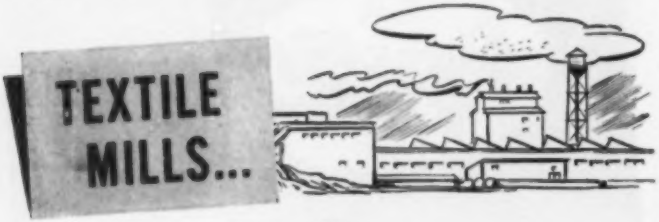

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Continuing tests indicate that rubber-base paints will resist common causes of corrosion three to four times longer than ordinary protective coatings. Exceptionally satisfactory service results are obtained in numerous industries where surfaces are attacked by acids, alkalies, and salts.

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Cellulose Products Department
952 Market Street, Wilmington, Delaware

CR51-3

process development, Sharples Corp., Philadelphia.

L. B. Parsons. Director of research and development, Lever Bros. Joined the company as a research supervisor in 1939. Subsequent jobs: chief chemist, manager of basic research laboratories, assistant director of research and development. Previously research director for Cudahy Packing Co. Doctorate from the University of Wisconsin.

L. B. Parsons

A. S. Johnson

Adger S. Johnson. President of National Carbon Co., a division of Union Carbide and Carbon. Has been vice president and general manager. Company history: joined in 1928; assigned to Eveready battery plant in Shanghai, China, 1933; superintendent of this plant, 1939; vice president in charge of production, 1944; vice president in charge of foreign plants, 1948. Chemical engineering graduate of Virginia Polytechnic Institute.

Edward G. Toenoes. Assistant chief chemical engineer, chemical phosphate division of Monsanto Chemical Co., Anniston, Ala. Washington University graduate.

A. C. Elm. Technical director, Standard-Toch Chemicals. For the past 22 years, member of the staffs of leading paint and raw material manufacturers.

James S. Wolff. Washington, D. C., representative of B. F. Goodrich Chemical. With Goodrich since 1946 most recently as technical representative in Chicago, Chemical engineering graduate of Carnegie Tech.

George Machwart. Member of the research department, Monsanto Chemical Co., Anniston, Ala. Formerly professor of chemical engineering at Michigan College of Mining and Technology. Doctorate from Ohio State.

Homer Kieweg. Manager, central division, production and engineering

LEVER BROS. *produces C. P. Glycerol*

without distillation... by ILLCO-WAY ionXchange

ILLCO-WAY De-ionizing eliminates step of distillation normally used... gives 99% yield of C. P. glycerol as compared to a 66% yield by distillation

Purification of crude glycerol — by ILLCO-WAY ionXchange — has proved to be both effective and economical. Cost of producing 1 lb. of 95% C. P. glycerol (starting with a sweetwater containing 15% glycerol and 0.4% ionized solids) is 0.45 cents. In addition, the de-ionized glycerol has considerably better shelf-life than the distilled product.

This is another illustration of the versatility of ILLCO-WAY ionXchange. Long a pioneer in the field of de-ionization, particularly in the treatment of water, ILLCO-WAY, through chemical and engineering research, has applied developments of ionXchange to a wide variety of products and manufacturing processes, including:

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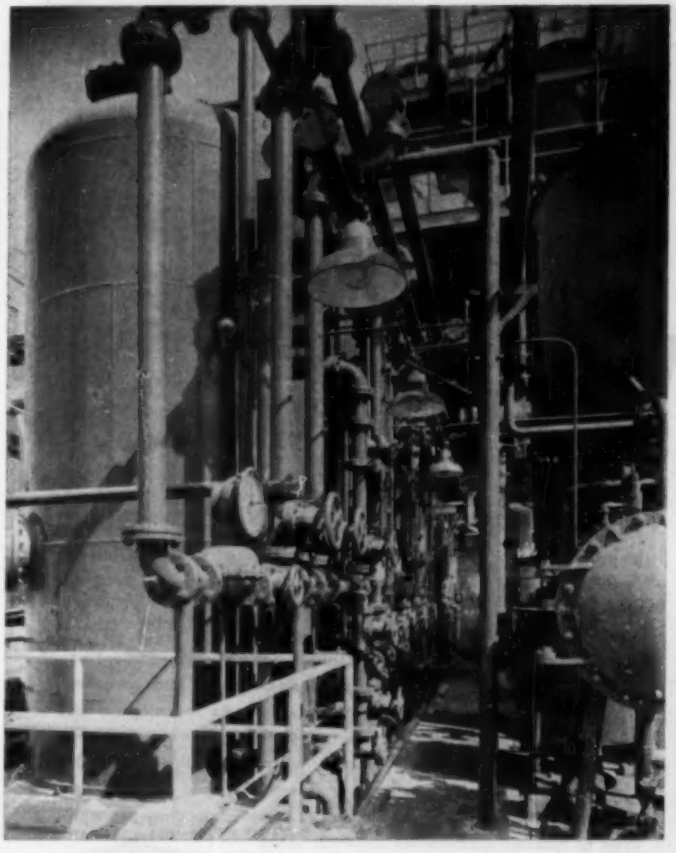
We will welcome from you or your production staff any inquiry concerning liquid purification problems which may involve ionXchange.



ILLCO-WAY ionXchange equipment for purification of soap lye crude, installed at Lever Bros. Co. modern new plant in Los Angeles. This unit replaces distillation equipment in the manufacture of C. P. glycerol.

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☐ Molasses ☐ Paint, Enamel ☐ Road Oil ☐ Soap, Glycerine
☐ Tar ☐ White Lead ☐ Others (see letter attached)

Name _____ Company _____

Address _____

NAMES IN THE NEWS, cont. . .

department, Commercial Solvents Corp. Formerly chief engineer of CSC's engineering division. Joined the company in 1935. Manager of the company's new Dixie division: **J. Eckard Wheeler**, formerly manager of the company's Sterlington, La., plant. Manager of the new western division: **R. B. Crowell**, formerly manager of the Agnew, Calif., plant.

R. L. Logan

R. Berg

Robert L. Logan. Process engineer, engineering division, International Minerals & Chemical Corp., Chicago. Some former positions: staff engineer, Goodyear Synthetic Rubber Corp.; project engineer, A. E. Staley Mfg. Co.; plant engineer, Manistee Salt Works. Chemical engineering graduate of the University of Minnesota. New process control engineer: **Robert H. Berg.** Previous employers: B. F. Goodrich, Goodyear Tire & Rubber, U. S. Naval Research Laboratories, Fischer & Porter, Panellit, Inc. Chemical engineering graduate of the University of Wisconsin.

Frank Grilli. From assistant manager to manager, chemical department, Innis Speiden, Inc., New York. New manager of the products development department: **J. P. Kesling**, formerly of the technical service department. New superintendent of the company's Jersey City plant: **E. D. Baumeister.**

Lyle F. Albright. Assistant professor, chemical engineering staff, University of Oklahoma. Formerly in the research development department of Colgate-Palmolive-Peet Co. Doctorate from the University of Michigan.

Jack D. Moore. Plant superintendent at Kaiser Aluminum & Chemical Corp.'s Natividad, Calif., dolomite plant. Previously assistant to works manager, chemical operations in California. Joined Kaiser in 1942.

Walt Adams. Acting works manager, Kaiser Aluminum & Chemical Corp.'s Baton Rouge, La., alumi-

num plant. Previously superintendent at Kaiser's Natividad, Calif., dolomite plant.

J. Fred Wilkes. Chairman of ACS division of water, sewage and sanitation chemistry for 1952. Technical director of the railroad department, Dearborn Chemical Co., Chicago; with company since 1939. Studied at the University of Florida.

A. H. Moseman. New chief of the U. S. Dept. of Agriculture's Bureau of Plant Industry, Soils and Agricultural Engineering.

S. A. Montgomery. From assistant general manager to general manager of manufacturing, Standard Oil (Indiana). His successor: **W. J. McGill,** superintendent of operations since 1948. Another new assistant general manager, manufacturing department: **R. C. Gunness.** His successor as manager of research: **J. H. Forrester,** formerly manager of the central division of the Stanolind Oil and Gas Co., producing subsidiary of Standard.

Francis Scofield. Chairman of ACS division of paint, varnish and plastics chemistry for 1952. Research chemist for the National Paint, Varnish and Lacquer Assn., Washington, D. C.

Daniel J. Heald. First recipient of a food processing fellowship established at Illinois Institute of Technology as a tribute to Harry McCormack, long-time director of the Institute's department of chemical engineering.

Glenn T. Seaborg. Chairman of ACS division of physical and inorganic chemistry for 1952. Professor of chemistry at the University of California.

Judd W. Healy. Group leader at the Wood River, Ill., laboratory of Standard Oil (Indiana). Formerly chemical engineer in the company's research laboratory at Whiting, Ind. Joined Standard in 1947. Studied at Penn State and MIT.

Frederick E. Frey. Chairman, ACS division of petroleum chemistry for 1952. Assistant director of research, Phillips Petroleum Co.

G. S. Williamson. To head the new $3 million petrochemical plant of Shell Oil Co. at its Montreal East refinery. Formerly assistant manager at the Shellburn Refinery of the company at Vancouver, B. C. Positions since joining Shell in

Versatility, plus *dependable purity* . . . that's the key to the success of Red Diamond CO_2 in filling so many increasingly diverse needs of industry . . . and doing it better. In refrigeration, in chemical processing, as a pressure medium and as an inert gas, the many uses of Red Diamond CO_2 is constantly expanding.

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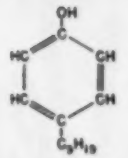
Nonyl Phenol

one of a series of Alkylated Phenols



NONYL PHENOL—one of Koppers series of alkylated phenols—is produced in commercial quantities. It is a slightly viscous, yellow to tan liquid; only very slightly soluble in water, but miscible with common organic solvents.

REACTIONS

Two of the three normally reactive nuclear positions are unsubstituted in this alkylated phenol; they are subject to such reactions as acylation, sulfonation, nitration, alkylation, and condensation with aldehydes.

The unhindered phenolic hydroxyl group undergoes such reactions as etherification, esterification, vinylation, ethylene oxide condensation, and formation of nonyl phenoxyacetic acid.

USEFUL APPLICATIONS

The properties of Nonyl Phenol indicate usefulness in the production of modified phenolic resins, non-ionic surface active agents, lubricating oil additives, antioxidants, plasticizers and agricultural chemicals.

PROPERTIES

Boiling Range	290°–300°C.
Hydroxyl Number (theory 255)	250
Specific Gravity, 30°C.	.940–.944
Refractive Index, 20°C.	1.5118

FOR FURTHER INFORMATION, write to Koppers Co., Inc., Chemical Division

KOPPERS

KOPPERS COMPANY, INC.
Chemical Division
Dept. CE-12, Koppers Building, Pittsburgh 19, Pa.

NAMES IN THE NEWS, cont.

1936: laboratory helper, chemist, senior chemist, process supervisor. Chemical engineering graduate of the University of British Columbia.

Anthony P. Massa. Chemical process engineer, H. K. Ferguson Co. Formerly, design and project engineer and production supervisor with the Stein-Hall Co. Chemical engineering graduate of Polytechnic Institute of Brooklyn.

A. P. Massa

J. R. Lill

John R. Lill. Manager of the new chemicals division of the J. M. Huber Corp. with headquarters at Borger, Tex. Formerly production superintendent and assistant to the plant manager, Mutual Chemical Co. of America.

William L. Rodich. Assistant general manager, laminated and insulating products department, GE's chemical division. Has been manufacturing manager of the chemical materials department since 1950. Previous employers: S. B. Penick and Co., Merck, Winthrop Chemical. Chemical engineering graduate of Brooklyn Polytechnic Institute.

David R. Longmire. New member of the research-development division of Wyandotte Chemicals Corp. Previous employers: I. M. Simon & Co.; Elliot Co. Studied at the University of Michigan. Also added to the research-development division: **Russell D. Ring.**

Sidney D. Kirkpatrick. Honorary trustee, Southern Assn. of Science and Industry. Editorial director of Chemical Engineering and Chemical Week. Cited for his editorial support of southern industrial expansion over a period of many years.

Henry H. Wall, Jr. From supervisor in process engineering to superintendent of pilot plants, Ethyl Corp., Baton Rouge, La. New manager of manufacturing technical service: **Thomas M. Smylie, Jr.**

George F. Kirby, Jr. Director of chemical research and development

SINCLAIR RESEARCH LABORATORIES—nine buildings containing the most modern testing equipment known—have contributed many of today's most important developments in petroleum products, production and refining. Under the Sinclair Plan, the available capacity of these great laboratories is being turned over to work on the promising ideas of independent inventors everywhere.

An Offer of Research Facilities to Inventive Americans Who Need Them

The Sinclair Plan is opening up the Company's great laboratories to every American who has an idea for a better petroleum product

INVENTIVE Americans are often at a loss today. Not because of any lack of ideas, but because of a need for expensive facilities to find out if and how their ideas work.

This was no obstacle in our earlier days. The Wright Brothers designed their first airplane with the help of a foot-square homemade "wind box"—and the plane flew.

In contrast, the man with a new idea in airplane design today often needs a supersonic wind tunnel costing millions.

In short, science and invention have become so complex that a man with an idea for a better product often needs the assistance of an army of specialists and millions worth of equipment to prove his idea has value.

Within the petroleum field, the Sinclair Plan now offers to provide that assistance.

Under this Plan, Sinclair is opening up its great research laboratories at Harvey, Illinois, to independent inventors who have sufficiently good ideas for better petroleum products or for new applications of petroleum products.

If you have an idea of this kind, you are invited to submit it to the Sinclair Research Laboratories, with the provision that each idea must first be protected, in your own interest, by a patent application, or a patent.

The inventor's idea remains his own property

If the directors of the laboratories select your idea for development, they will make, in most cases, a very simple arrangement with you: In return for the laboratories' investment of time, facilities, money and personnel, Sinclair will receive the privilege of using the idea for its own companies, free from royalties. This in no way hinders the inventor from selling his idea to any of the hundreds of other oil companies for whatever he can get. Under the Plan, Sinclair has *no control* over the inventor's sale of his idea to others, and has *no participation* in any of the inventor's profits through such dealings. Moreover, it is a competitive characteristic of the oil business that the new products adopted by one company are almost invariably adopted by the whole industry. This means that the very fact of his agreement with Sinclair should open up to the inventor commercial opportunities which might otherwise be hard to find.

How to proceed: Instructions on how to submit ideas under the Sinclair Plan are contained in an Inventor's Booklet available on request. Write to: W. M. Flowers, Executive Vice-President, Sinclair Research Laboratories, Inc., 600 Fifth Avenue, New York 20, N. Y. for your copy.

IMPORTANT: *Please do not send in any ideas until you have sent for and received the instructions.*

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NAMES IN THE NEWS, cont. . .

at Ethyl Corp.'s research laboratories in Detroit. His successor as the company's chief engineer at Baton Rouge: **A. Clarke Burdick, Jr.**, formerly superintendent of maintenance at Houston.

Henry T. Stetson. From vice president to president, Safety Car Heating and Lighting Co., New Haven, Conn. With the company since 1912.

H. T. Stetson

F. E. Maple

Frank E. Maple. Assistant general manager, industrial chemicals division of Commercial Solvents. Joined the company's production department in 1936. Has also served in the research department and the sales department's technical service division. Chemistry graduate of the University of Illinois.

David B. Hatcher. General manager, Stepan Chemical Co., Chicago. Formerly with Libbey-Owens-Ford Glass Co.'s Plaskon Division as associate director of research then sales manager for glues and industrial resins.

Wilson R. Barnes, Director of research, Corhart Refractories Co., Louisville, Ky. Formerly associate professor of chemical engineering, University of Louisville and director of its institute of industrial research. Doctorate from Iowa State.

W. C. Hewitt. From process consultant to superintendent of operations, Phillips Chemical Co., Bartlesville, Okla.

Glenn Purcell. From assistant superintendent to superintendent, Shell Chemical Co.'s Deer Park, Tex., plant. **Frank E. Caddy:** From manager at the company's Martinez, Calif., plant to manager of the Deer Park, Tex., plant. **Frank G. Watson:** From operating department manager to assistant superintendent, Deer Park plant.

James W. Tracht. Assistant chief engineer, Pennsylvania Salt Mfg. Co. Formerly assistant superintendent

of the company's Wyandotte works. Another assistant chief engineer: **G. R. Evans,** formerly senior chemical and project engineer.

Edward R. McLean. From assistant to the manager to manager, planning section, Du Pont's nylon division. Joined Du Pont as a chemist at the explosives department plant, Carney's Point, N. J., in 1939. Chemical engineering graduate of Princeton.

H. N. Mallon. Chairman of the board of governors of the Institute of Inventive Research, a division of the Southwest Research Institute, San Antonio, Tex. President of Dresser Industries of Dallas.

L. S. Wescoat. Chairman of the board for 1952, American Petroleum Institute. He is with the Pure Oil Co., Chicago. A new director of the institute: **K. S. Adams** of Phillips Petroleum Co.

Russell G. Whittemore. Acting director, product development department for Pittsburgh Plate Glass Co.'s glass division. Technical representative of the product development department for the past eight years. With the company since 1930. Graduate of Worcester Polytech.

Max Leva. Visiting lecturer, part-time, in thermodynamics and kinetics, chemical engineering department at West Virginia University. He is a consulting engineer of Pittsburgh, Pa.

John F. Foster. Chairman for 1952 of the ASC division of gas and fuel chemistry. Supervisor of fuels research at Battelle.

W. T. Nichols. Vice president of AIChE for 1952. Since 1949, director of the general engineering department, Monsanto Chemical Co., St. Louis. Previously with Westvaco for nine years.

OBITUARIES

Frank H. Merrill, 80, president of Los Angeles Soap Co., died in Los Angeles October 12. He was credited with developing the first soap to prove satisfactory in electric washing machines.

Gerald E. Bryand, 85, a retired sugar chemist who spent most of his life trying to develop Hawaii's modern methods of sugar growing and refining, died October 14.

BARNSTEAD DEMINERALIZERS

PROVIDE LOW-COST

PURE WATER

for • **Electroplating** • **Anodizing**
• **Photographic Solutions**
• **Salt-free Rinse Water** • **Silvering**

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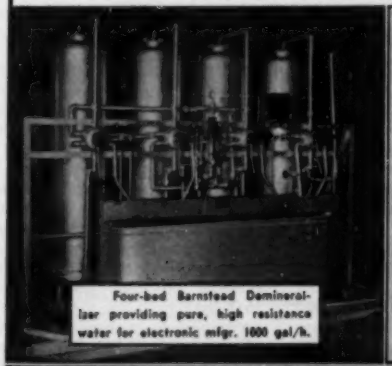

Four-bed Barnstead Demineralizer providing pure, high resistance water for electronic mfgr. 1000 gal/h.

Barnstead Four-Bed Demineralizer provides pure water for hot seal tank in anodizing. 30 gal/h.

Two-bed Barnstead Demineralizer. Used in large automotive plant. 1000 gal/h.

Four-bed Barnstead Demineralizer produces pure, sparkling-clear rinse water for pharmaceutical plant. 200 gal/h.

Selection of the best size and type of demineralizer for your operation depends on the nature of your raw water supply, flow rate needed, daily demand, and degree of purity required. Send a sample of your water to our Laboratory and Barnstead Engineers will perform the necessary analysis without obligation.

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INDUSTRIAL NOTES

NEW NAMES

Millmaster Chemical Corp., New York, has changed its name to Berkshire Chemicals, Inc. Its executive offices have been moved to 11 West 42nd St.

Laminated Plastics, Inc., Cleveland, has changed its name to Glastic Corp. to correspond with the trade name under which all its products (glass reinforced plastics) are sold.

NEW LOCATIONS

Baker Oil Tools Co. has moved its entire plant and office facilities to its new building at 7400 East Slauson Ave., Los Angeles.

Rayonier Inc., New York, will move its executive and sales offices to the new Chrysler Bldg. East about the first of the year.

Witco Chemical Co., Ltd., London, England, has moved to Bush House, Aldwych.

NEW REPRESENTATIVES

Baker Equipment Engineering Co. has been appointed to handle Yale & Towne Mfg. Co.'s line of materials handling machinery in the Charleston, W. Va., marketing area.

O'Brien Steam Specialty Co., Syracuse, N. Y., has been appointed exclusive U. S. distributor for the Cox direct-diffusion steam-water heaters. These all-bronze, packed-column heaters have been made in England for over 15 years.

American Mineral Spirits Co. has been appointed as distributor of aluminum pastes and gold bronze powders manufactured by Metal Disintegrating Co., Elizabeth, N. J. Territory covered includes the New York area, New Jersey, eastern Pennsylvania, Maryland and Delaware.

NEW LINES

Strux Corp., Lindenhurst, L. I., N. Y.—Cellular cellulose acetate through the acquisition of the production facilities of Aircraft Specialties Co.

Pittsburgh Plate Glass Co.—Fiber glass. Formation of a separate development and production unit to be known as the fiber glass division is now in process. J. Hervey Sherts will serve as general manager.

Houghton Laboratories, Inc., Olean, N. Y.—Plastisols and organosols. To make this possible, production facilities at both the Smethport, Pa., and the Olean plants have been expanded considerably.

NEW COMPANIES

Petrocel Corp., a subsidiary of Celanese Corp. of America to carry on oil and gas exploration and development work for assuring the company's raw materials position in petrochemicals.

Russell Reinforced Plastics Corp., Hicksville, L. I., N. Y., to manufacture low pressure laminates and flat board stock of Fiberglas-polyester construction.

H. L. Barneby, Chemical Processes, to act as licensing agent for companies that have important processes which they are willing to license to others; to find and evaluate possible processes for companies that have need for a technique to accomplish a particular operation. Company founder Barneby was formerly with Blaw-Knox.

Union Carbide International Co., a division of Union Carbide and Carbon Corp., to succeed the foreign department of the corporation.

H. M. Johnson, Inc., Elizabeth, N. J., to offer chemical manufacturers services covering every phase of marketing chemical raw materials to manufacturers of paints, varnishes, lacquers, and allied materials.

NEW FACILITIES

Filtrol Corp., West Coast producer of petroleum cracking catalysts—A research building in Vernon, Calif., to be completed by mid-1952.

Union Oil Mill, Inc.—A 100-ton-a-day chemical solvent plant at West Monroe, La., to be completed by May 1952.

Consolidated Chemical Industries, Inc., San Francisco—A $500,000 plant at Baton Rouge, La., for recovery of sulphur from oil refinery waste hydrogen sulphide. Consolidated has also completed plans to have a larger $3.5 million plant built at Baton Rouge to handle spent acids of the Louisiana division of Esso Standard.

Standard Oil Co. of California—A $1.5 million expansion of alkane plant facilities at its Richmond refinery. The increased capacity of 3,000 bbl. per day will supply detergent alkane for Oronite Chemical Co.'s (Stancal subsidiary) expanding production of synthetic household detergents.

Columbia Cellulose Co. Ltd.—Installation of new equipment and machinery to increase capacity from 200 to 300 tons per day at its Prince Rupert, B. C., plant. Included will be a new water treatment building.

Union Oil Co.—New asphalt facilities costing $1.65 million at its Oleum, Calif., refinery.

Kaiser Aluminum & Chemical Co.—Expansion of primary aluminum capacity from 100,000 to 200,000 tons per year at its New Orleans aluminum reduction plant. A certificate of necessity has been granted and GSA has signed a contract with Kaiser whereby the government guarantees to purchase all production from the plant that is not otherwise marketed in the first five years.

Vapor Recovery Systems Co., Compton, Calif.—A manufacturing affiliate in Paris, France. Known as the Compagnie Technique de Petroles, it will make tank equipment, gas control and safety devices from master patterns fabricated at the home plant.

American Resinous Chemicals Corp.—Plant expansion that has doubled production of concentrates of synthetic rubbers and resins in paraffin and microcrystalline waxes.

Libbey-Owens-Ford Glass Co.'s Plaskon division, Toledo—A New England office for glues and industrial resins.

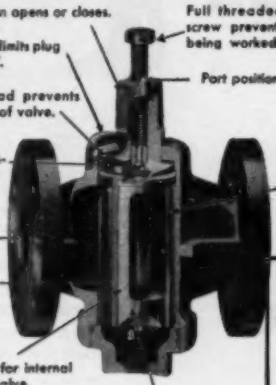
Abbott Laboratories, North Chicago, Ill.—A $315,000 antibiotics finishing building.

Shell Chemical Corp., New York—A sales office in Atlanta, Ga., under the management of M. W. Ellison.

We Make ALL Types of PLUG VALVES

ONE OF THEM IS THE RIGHT VALVE FOR YOUR NEEDS

HOMESTEAD-REISER "Self-Seald" LUBRICATED PLUG VALVES


Quarter-turn opens or closes.
Full threaded lubricant screw prevents dirt from being worked into valve.
Outside stop limits plug travel to 90°.
Port position indicator.
Pressure-sealed head prevents leakage around top of valve.
Stainless thrust shim eliminates gasket wear.
Self-Seald—Wedge action of divided plug gives extra tight seal against leakage.
Straight line fluid flow. Streamlined ports.
100% port seal; lubricant fully surrounds valve ports.
Automatic adjustment for internal wear extends life of valve.
Sealing surfaces protected from corrosive or erosive line fluids.

Straight-way—
Worm & Gear Operated

Flow Changer—
Non-lubricated

HOMESTEAD CAM-SEALD (dry seat)

HOMESTEAD LEVER-SEALD (quarter turn)

Straight-way—
Flanged or Screw Ends

Straight-way—
Flanged or Screw Ends

How the Amazing "Self-Seald" Principle Works

Homestead-Reiser's patented "Self-Seald" principle is, we believe, the simplest and most effective sealing principle yet developed for lubricated plug valves.

In addition to a full lubricant seal around the ports, and around the top and bottom of the valve, the wedge-action of the divided plug under line pressure, causes the finely-finished surfaces of both segments of the plug to press outward against the sealing surfaces of the body.

This self-sealing action keeps the plug surfaces in contact with the mirror-like bore of the body. The plug automatically adjusts itself for wear, thus assuring extra long life and maximum leakless service.

For complete information, sizes and prices, write for Catalog 39-S. No obligation.

Three-way—
Screw or Flanged Ends

Four-way—
Flanged or Screw Ends

Four-way— Flanged or Screw Ends

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Where protection from leakage is essential . . . where tampering with product is not tolerated . . . where security from losses is a *must* . . . you will find drums equipped *with Tri-Sure Closures*.

Give your products *certain* protection in transit—and give your customers *proof* of full value in full drums—by specifying "Tri-Sure Closures" on every drum order.

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There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.

SHALE OIL:	Single Plant	Multi Plant (5)
Construction materials, Steel, M tons	178	694
Per daily bbl. of total liquid fuel production, tons	4.5	3.5
Construction Labor, man/hr. x 1,000	26	123
Investment, total, millions	333	1,518
Dollars per daily bbl. product	8,400	7,500
Cost of gasoline with 6 percent return on investment after income tax, c./gal.	16.2	14.7

HOW MUCH?

SHALE OIL:	Single Plant	Multi Plant (5)
Shale, tons/calender day	76,800	384,000
Product (42 gal. bbl.), bbl. day:		
Gasoline	25,380	126,900
Diesel fuel	12,200	62,360
LPG	1,780	8,920
Residual fuel	340	3,050
Total, bbl./day	39,700	201,230
Coke, tons/day	1,180	5,900
Fuel gas, M standard cu. ft./day	24,830	124,150
Ammonia, tons/day	92	460
Sulphur, tons/day	43	215
Manpower, total	3,420	15,750

FOR WHAT?

1952: Synthetic Liquid Fuels?

Special committee of the National Petroleum Council quadruples Bureau of Mines figures on coal hydrogenation: from 11 c. per gal. of gasoline to 41.4 c. per gal. Oil shale looks more promising at 14.7 c.

In 1944 the U. S. Bureau of Mines began an intensive synthetic liquid fuels research program. In April, 1950, Oscar L. Chapman asked the National Petroleum Council to check into the dollar-and-cents aspects of synthetic fuels. Two months ago, the committee reported its findings. That report is digested below.

SCOPE OF STUDY

1. Review estimates made by the Bureau of Mines for the cost of producing synthetic liquid fuels, and its estimates of comparative costs of producing liquid fuels from crude oil.

2. Prepare independent cost estimates.

3. Make recommendations as to ways and means, if any, for improvement of future cost estimates by the Bureau of Mines.

The investigation has been limited to the process steps upon which the Bureau of Mines cost data have been based.

To increase the general usefulness of this study it was considered desirable to determine costs not only for possibly unique situations which might arise from a particularly favorable or unfavorable first-plant location, but also for a more nearly average case in which a number of plants would produce a combined total for each process of around 200,000 bbl. of liquid fuels per day. Thus estimates of costs and of material requirements were determined for both single plant and multi-plant cases.

The work of the committee has required considerably more time than originally anticipated because it was found that necessary process design data had not been sufficiently developed by the Bureau of Mines. Consequently, additional process design data were developed in order to arrive at suitable bases for cost estimates.

The data on coal hydrogenation follow:

Coal Hydrogenation

	Single Plant	Multi Plant (8)
Coal, tons cal. day	13,960	112,590
Products, bbl. day		
Gasoline	19,490	163,830
LPG	6,390	52,170
Total	25,880	216,000
Chemicals, bbl. day		
Phenol	229	0
Cresols	383	0
Xylenols	505	0
Manpower, total	5,900	53,800
Construction Materials		
Steel, M tons	220	1,710
Per daily bbl. of total liquid fuel production, tons	8.5	7.9
Construction labor		
Man hr. x 1,000	51	355
Investment		
Total, Million $	533	4,074
$ daily bbl. product	20,600	18,900
Cost of gasoline with 6 percent return after taxes, c./gal.	41.4	43.5

THE PROCESS

The estimates for the coal hydrogenation operation are based on procedures which were developed in Germany and on the assumption that coal is available in sufficient quantity, at a mineable depth and thickness and at a location having water required for the operations. The coal is prepared for hydrogenation by cleaning and crushing operations which reduce the ash content to as low a value as is practical and which brings the coal to a size suitable for the hydrogenation operation. In the cleaning and crushing operations, a large amount of higher ash content and other off-grade coal is produced and this is used for steam generation and other heat duty.

The clean, fine coal is mixed with heavy oil recycled from the process to produce a paste. This paste is charged to the liquid phase hydrogenation operation along with a small amount of catalyst. At approximately 10,000 psi. and at a temperature of 900 deg. F., a large portion of the coal is liquified. The material leaving this stage of the process is distilled to obtain a light oil and a heavy oil. Part of the heavy oil is recycled to the pasting operation and the remainder is coked to provide a means of rejecting the ash and used catalyst. In a second stage the light oil is hydrogenated over a fixed bed of catalyst at 10,000 psi. and 900 deg. F. to yield gasoline and LPG. Certain chemicals (phenol, cresols, xylenols) can be recovered for the first stage product, as it was assumed in the coal hydrogenation single plant case in the summary (see cut). If not disposed of as chemicals, these products can be processed in the second stage to yield gasoline and LPG, as was assumed in the case of multi plants. Conventional petroleum refining procedures are used for the final treatment of the products from the coal hydrogenation operation.

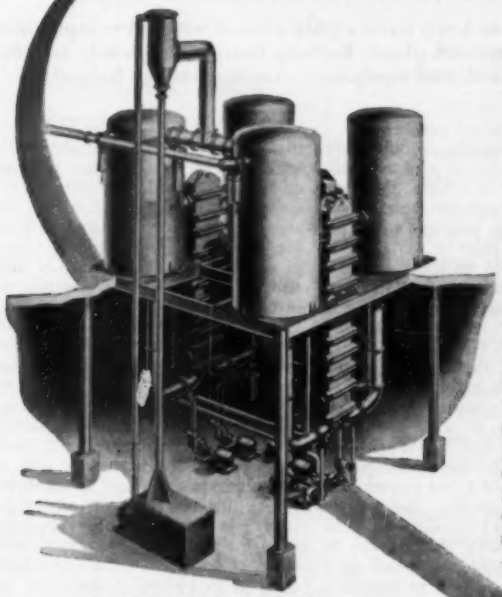
OIL SHALE

Estimates for the oil shale operation are based on the assumption that shale is mined in large scale operations according to techniques developed by the Bureau of Mines. The shale from the mines is then crushed to a suitable size and charged to a retort in which the oil is broken out

Conkey Flat Plate Evaporators with Rosenblad Switching System*

Completely self-cleaning during operation

No down time! No scale removal costs!



Conkey 4-Body Triple Effect Flat Plate Heating Surface Evaporator

Take a leaf from the flow sheets of another industry. For years evaporation of spent sulphite pulp cooking liquors in sulphite pulp manufacture was considered highly impractical because a gypsum coating developed on heating surfaces. But today—it can be a *continuous, full capacity self-cleaning operation* through use of Conkey Evaporators and Rosenblad Channel Switching System.

The advantages of the Rosenblad Channel Switching System have been thoroughly proven both in this country and abroad. Heating surfaces, interconnecting pipe and pump systems *are completely cleaned during normal operation!* It's especially effective wherever lime salts scale evaporators.

Conkey equipment adapts itself well to channel switching for self-cleaning operation while providing all the other advantages of multiple effect evaporation: forced circulation . . . falling film . . . recompression . . . thermal compression . . . high vacuum and other specialized benefits where required.

*Patents Applied For

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QED, *cont. . .*

by the action of high temperatures. The necessary heat is obtained by burning—in a separate part of the retort—the carbon remaining in the shale after the oil has been driven out.

The crude shale oil thus obtained contains sulphur and nitrogen compounds and is highly unstable. The oil is subjected to coking operation and the resulting coker distillate is catalytically hydrogenated under moderate conditions (1,100 psi. and 835 deg. F.). This hydrogenated distillate yields materials which are processed by conventional means to recover finished and semi-finished products which are transported by pipe line from the plant to a major consuming area. Finishing operations as required are carried on at the pipe line terminus.

When this study was started the only data available from the Bureau of Mines on the cost of producing synthetic liquid fuels from coal was its Report of Investigation 4,564 which was issued in 1949. To make these data realistic it was necessary to escalate these cost estimates to adjust for inflation of material and labor costs. After this adjustment and on the basis of comparable facilities, the Bureau of Mines investment cost estimates were approximately 20 percent below the cost estimates prepared by this committee. However, the Bureau of Mines estimates omitted such items as certain off-site facilities, necessary interest on borrowed capital, income taxes, reasonable profit on investment and treatment of other important capital cost items which must be considered. Detailed analysis of these differences is presented in the subcommittee reports made available to the Bureau of Mines. It should be emphasized that costs developed by the subcommittee are as authoritative as can be obtained without actual commercial operating experience of the processes considered.

In this study, the income tax rate has been taken at 50 percent of income before taxes. No effect has been given to excess profits taxes.

Although a figure of 6 percent return on the investment was employed in computing the gasoline cost, it is regarded as highly doubtful that capital could be attracted to so speculative an enterprise at so low a return. Price Waterhouse & Co. (the accounting firm that audited the report) stated the "opinion that an annual rate of earnings of not less than 15 percent on the total capital invested in or retained in a business subject to the risks of a highly competitive and speculative enterprise would be necessary and reasonable in order to attract investment of private capital."

The information presented in this report which is, in turn, based on detailed technical studies, leads to the conclusion that coal hydrogenation for the production of synthetic liquid fuels is uneconomical.

It has been noted that an effort is being made to promote the installation of a coal hydrogenation plant as a source of chemicals, the most important of which are benzene, toluene and xylene. Study of this proposal is not within the scope of the committee's assignment. Attention is directed, however, to the fact that the disadvantages of high investment cost involved in the basic coal hydrogenation step will still be present and that additional investment will be required for further processing, recovery and purification of the chemicals. We are advised that such chemicals can be produced from petroleum at much lower cost.

The oil shale phase of the synthetic fuels program is in a much more favorable position as to steel requirements, capital costs and operating expenses. It is estimated that known oil shale reserves will yield in excess of 100 billion bbl. of oil. Excellent work has been done by the Bureau of Mines in the development of shale mining on a large scale. The future trend of oil shale development will, of course, be affected by the trend in cost of gasoline from crude petroleum.

From the Report of the National Petroleum Council's Committee on Synthetic Liquid Fuels Costs, Oct. 31, 1951.

Short Cuts in Pilot Plants

How to keep costs within reason without compromising the commercial plant. Kellogg found that closely coordinated personnel, and equipment standardization helped.

J. S. Rearick

There are a number of differences between the design of pilot and full-scale units. But in a word, the commercial unit is specific: specific capacity, feed-stock, products and quality. The pilot plant is versatile: it must be designed to operate over a wide range of conditions on a variety of feeds. Capacity per se is of little importance, as is economy of heat or utilities.

Regardless of the purpose of the pilot plant, it is highly desirable to first attempt to visualize the full size plant and then to scale the latter down to pilot size. Although this might seem to be the reverse procedure in the case of a new process, it is actually not, since the function of the pilot plant is to predict the operation of a full scale unit. Failure to consider this point may result in a pilot unit which will not produce data applicable to any larger scale.

ORGANIZATION

A major factor in the success or failure of a pilot plant program is the skill and thoroughness employed in the mechanical design of the unit. Pilot plant operations are costly and much time and money may be lost as a result of mechanical inadequacies of the equipment. Here again compromise is necessary to produce a satisfactory plant at a reasonable engineering cost. The guiding principles which were used in attacking this problem might be expressed as: continuity, coordination, and standardization. By assigning one individual to each project to follow it from the initial stages of design to final completion of construction, much of the lost motion involved in relaying information was eliminated. By close coordination between process design, fabrication and construction—as well as construction personnel—the amount of detail required was greatly reduced. By developing standard designs and details for certain types of equipment, drawings could be used repeatedly with, at the most, minor changes or additions.

The design engineer to whom the project is assigned is the key man from the first preliminary rough estimate of plant cost until the pilot plant is in successful operation. He participates actively in establishing the process design, serves as advisor to the mechanical section during fabrication and construction and provides technical assistance within his field during initial operations.

In the case of a large project he may have one or more junior engineers assigned to assist him. After the process design has been approved, a detailed flowsheet is prepared. This flowsheet will show, by means of schematic diagrams, all the process lines,

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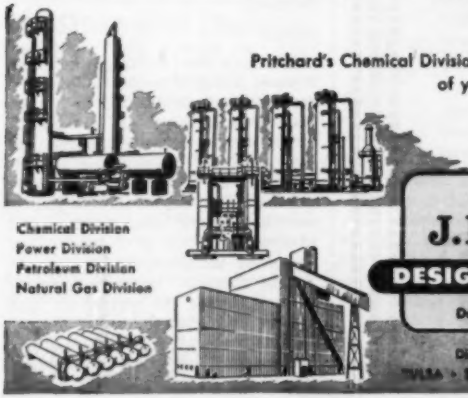

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equipment and instrumentation. Utility lines are generally not shown except for points of connection to the equipment. Where the scope of the job requires it, a separate utility diagram may be prepared. The flowsheet is the most important drawing and serves as key to the entire job. As the design progresses, additional information—such as line, equipment and instrument designations—is added to it. It is of great value to the operating personnel prior to and during the start-up of the new plant, and a copy is usually mounted permanently at the site. The designations shown on the flowsheet are also placed on metal tags permanently attached to the valves on the plant for ease of identification.

EQUIPMENT

Numerous short cuts are employed in the design of equipment to be fabricated, many of which are possible because of the close liaison that exists between the design and mechanical sections and the experience of the latter in this type of work. Drawings of equipment are prepared in far less detail than would be necessary for an outside vendor. Liberal use is made of symbols and standard details. These include drawings for certain frequently used types of equipment which require only the addition of a few dimensions, etc., before release for fabrication. For example, electrically heated lead pots are commonly used for heating small streams to relatively high temperatures. Standard designs have been prepared for these as well as for helical coil gas fired heaters to handle larger quantities. Standard designs have also been prepared for various sizes of coil type coolers. Methods and equipment developed by the mechanical section have greatly facilitated and reduced the cost of winding the coils for such purposes.

PIPING

Although there are instances where accurate sizing of piping is necessary, generally it is not required, and it has been advantageous to use ¼ in. Schedule 80 (extra heavy) seamless pipe with 3,000 lb. forged valves and fittings for all process lines wherever possible. This might, at first glance, seem extravagant, since in many cases cheaper materials or a smaller size would be adequate for the service. Piping materials, however, represent a small part of the cost of the unit and it is felt that the saving in engineering time and simplification of purchasing and stock room operations more than offset the increase in cost.

G-E Pyrometer Equipment Quick and Easy to Inspect, Maintain

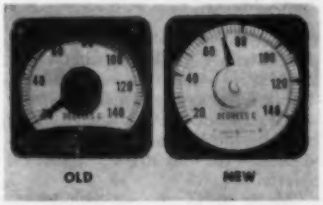
Routine inspections of new General Electric Type HP pyrometers can quickly be made. Besides making preventative maintenance easy, this equipment has many other features to provide accurate indication and temperature control of furnaces, ovens kilns, and other industrial heating equipment.

ACCURATE WITHIN ¾ OF 1% full scale, HP-3 pyrometers have automatic cold-junction compensation that adjusts for changes in ambient temperature.

Any change in temperature, even as small as 0.1% full scale, starts immediate control action. Normal changes in humidity, ambient, and voltage have little or no effect on the exactness of control action.

FOUR TYPES AVAILABLE—indicating, protecting, two- and three-position control forms; also both flush and surface mountings. All available in a variety of temperature ranges in the 0-3000 F span.

Mail the coupon for complete information about Type HP pyrometers.



New Shadow-proof Temperature Indicators Are Easier to Read

Temperatures from −100 F to +300 F can now be accurately indicated and controlled with General Electric's new line of temperature indicators. These instruments can be read from almost any angle. The dial is set forward, flush with the front of the case. A protruding convex-type glass front provides clear illumination. No more cover overhang; no more shadows caused by overhead lighting. Two sizes available—4½- and 8¾-inches. Check coupon.

New Resistance Thermometers Accurately Indicate and Control Low Temperatures

TEMPERATURES FROM −100F to +300 F can now be accurately indicated and controlled with General Electric's new line of resistance thermometers. They indicate accurately within ¾ of 1 per cent full scale. Any change in temperature equivalent to 1/10 of 1 per cent full scale starts immediate control action.

Normal changes in humidity or room temperature do not affect the exactness of control. Neither does a change in control voltage. Sturdy, simple construction assures reliable operation under severe operating conditions.

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THERMOCOUPLE POTENTIOMETER measures temperature in locations inaccessible to glass-stem thermometers. Any number of different readings can be taken in rapid succession and accurate within ±0.2% of full scale.

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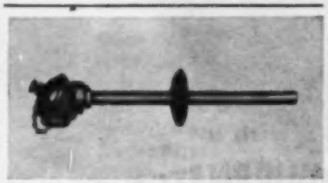

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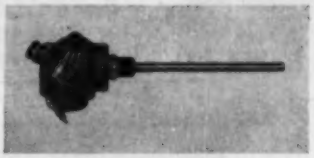

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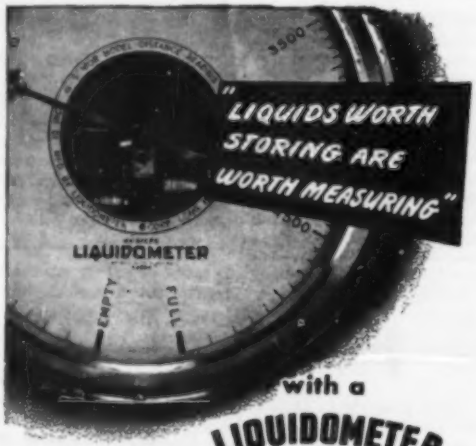

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QED, cont. . .

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J. S. Rearick, M. W. Kellogg Co., before the American Society of Mechanical Engineers, Tulsa, Sept. 24, 1951.

VINYL COATINGS

. . . *Tough, Lasting*

C. G. Munger

Since vinyl resin coatings are only used where difficult corrosion exists, application cannot be over stressed. But there is nothing difficult in the application of vinyl coatings. They may be brushed or sprayed without difficulty; the only major requirement is care.

Much of all coating failures are caused by improper application and poor surface preparation. A dry metal surface is essential for proper adhesion. The coating thickness and its continuity are also of major importance.

Experience has shown a vinyl coating is most effective when applied in a system coating—the use of a prime, intermediate and seal coat. The prime coat must of necessity be highly resistant. In addition, it must be penetrating, have good wetting properties and apply easily. The intermediate coat need have none of these properties. Their main purpose is to build thickness. The final coat provides a seal and has a low pigmentation. Such a system makes full use of the basic properties of vinyl materials.

Many types of refinery equipment have been more effectively protected by vinyl coatings than by any other method of protection. Some examples are: exterior of caustic tanks, acid plant areas subject to sulphur dioxide fumes, tanks exposed to general refinery fumes, interiors of acid sludge tanks, pipe lines subject to treating liquids, and concrete pipe for refinery sewers.

Vinyl coatings last. Previous exterior coatings for caustic tanks had a life of one serious spill. But vinyl coatings in use under overflow conditions have been unaffected for more than two years service. In another case (the interior of an acid sludge tank), it was stated that if the vinyl coating would last 6 mo., it would be longer than any other coating. The interior was sandblasted, a vinyl coating system applied, and the tank placed in service. Later an inspection was made, and the coating was found in perfect condition after two years continuous use.

C. G. Munger, Amercoat Corp., before the American Society of Mechanical Engineers, Tulsa, Sept. 24, 1951.

ALKYD RESINS

...*A Bright Future*

S. Lauren and M. A. Coler

Horizons for alkyd resins, it seems safe to say, are broadening. Tremendous strides in improving the quality and increasing the versatility of alkyds have been made in fifteen years.

They have not been displaced by the appearance of new resin types; in fact they have helped advance such new types as urea and melamine formaldehyde resins. Alkyd research chemists know the advantages of other resin types. They seem to have been guided, to some extent, by the old precept "If you can't lick 'em, join 'em." Join them they have; they have met the expanding needs of many industries by developing new molecular arrangements and physical combinations.

In the field of oil modified alkyds, research programs—which produced improved resins made with pentaerythritol and sorbitol—will undoubtedly be pursued intensively. Research will inevitably find ways to use even a wider variety of highly functional reactants.

In general however alkyd chemists are looking to the day when alkyds are free from dependence on natural drying oils. Investigations of synthetic "drying" type acids such as sorbic acid, and of polyfunctional compounds like glycerol allyl ether are in-

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QED, *cont. . .*

dicative of the direction of their work. The synthetic organic chemical and alkyd resin industries will move forward together.

S. Lauren and M. A. Coler, Markite Co., before the American Institute of Chemical Engineers, Newark, May 8, 1951.

METERING SULPHUR

. . . *New Methods*

James R. West, E. S. Boe and C. E. Butterworth

The use of head meters, area meters and calibrated weirs represents new developments in the metering of liquid sulphur. In the past, measuring tanks have been used for metering liquid sulphur. By periodically opening and closing the inlet and discharge valves before and after filling the tank with liquid sulphur, a known quantity of sulphur may be metered. Mercoid switches actuated by the sulphur level actuate recorders and by integration the total flow for a period may be calculated.

This method may be superseded by one or more of new metering systems recently tried out. Orifice plates with three different orifice diameters were used in 1-in. steam-jacketed pipe. Measuring the differential pressure proved to be the problem here, but the use of a special manometer made the use of this meter feasible. After coefficients of discharge were calculated, by calibration from a standard tank, accuracy to within 3 percent was found.

A 1-in. venturi meter was used with the same type of manometer as with the orifice meter. The discharge coefficients obtained here were as much as 18.5 percent lower than those found in the literature for the same Reynolds numbers.

In the calibration of a rotameter, sulphur was pumped through the meter both against back pressure and against no back pressure. Over the range studied this meter was accu-

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"Much has been said about the vulgarity of the money motive. But I doubt one could find a cleaner or more honest basis for rewarding high performance. A desire for power is surely less worthy, and I cannot believe that efforts simply to win the admiration of the crowd are ethically more desirable."

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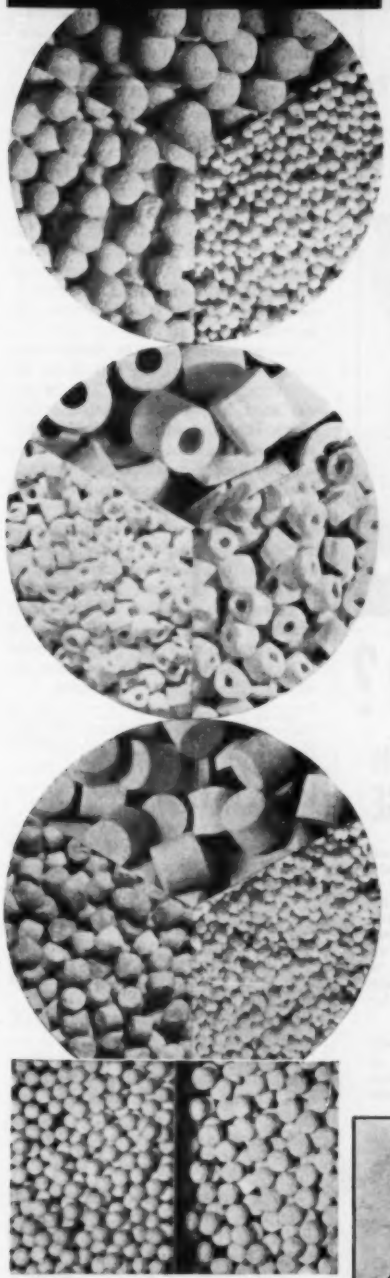

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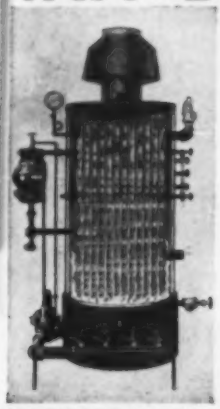

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QED, cont. . .

rate to approximately 2.5 percent. Severe problems present themselves in the use of a rotameter, such as corrosion due to moisture in the sulphur, plugging of the area meter due to extraneous material, and extremely high temperatures which raised the viscosity of the liquid sulphur too high.

Weirs with rectangular and V-notches were cut from 1/32-in. stainless steel and these weirs calibrated against a standard tank. The V-notch weirs with an angle of 60 deg. and 90 deg. did not prove to be as accurate as a 90-deg. weir, which was accurate to within 0.4 percent. A rectangular weir was accurate to 17 percent.

An oscillating piston meter was used in the range from 1 to 7 gal. at pressures up to 150 psi. The meter was used in a steam-jacketed vessel which kept the sulphur liquid. This meter is simple of construction with one-way flow through ports which are always open. This meter performed with accuracy better than 25 percent.

The last type of meter was a proportioning piston pump which had its cylinders immersed in liquid sulphur and which delivered to a steam-jacketed line. Delivery at high back pressures was slightly lower than the calibration, but at low back pressures the pump calibration proved correct. The worst error was 3.7 percent.

James R. West, E. S. Boe and C. E. Butterworth, Texas Gulf Sulphur Co., before the American Institute of Chemical Engineers, Rochester, Sept. 19, 1951.

COST ESTIMATION

. . . *A Method*

Robert P. Wilson

Procedure is as follows:

1 Find out what is to be done—obtain flow diagrams, plot plans, utility surveys and specifications of materials to be used.

2 Break the job down into comprehensible items.

3 Estimate the costs of individual items and summarize these costs.

4 Prepare a revised estimate, if consideration is long delayed.

5 To improve technique, compare final job costs with originally estimated costs.

Since estimates cost money, first determine if the expense is warranted. Refer to the construction cost of similar existing units.

Next obtain the following information: (1) A flow diagram and plot plan of the proposed installation; (2) a materials specification list; (3) a

statement or advance knowledge of the construction characteristics; and (4) a survey of available utilities.

With this information, the estimator can attack the problem intelligently. Now the estimated cost of the individual components can be made:

Main equipment: Main process equipment is generally purchased prefabricated. Therefore, submit requirements or sketches to various manufacturers or fabricators for bids.

Foundations and structures: Concrete foundations are generally estimated on a cost per cubic yard basis. The cost includes excavation, forming, fabrication and installation of reinforcing, pouring, finishing, removal of forms and clean-up.

Erection of equipment: A knowledge of available power equipment and other facilities together with first or second hand information regarding the number of man-hours required for the job will produce a cost figure of probable accuracy.

Pipe, valves and fittings: Reference to the flow diagram, plot plan and material specifications is made. Generally the major portion of this item is the cost of valves. Particular attention must be paid to specifications for the cost of 4 in. valves; it may be anywhere from $50 to $1,000.

Insulation: Material specification lists are again consulted to obtain information about the types and thickness. Labor and material cost are then estimated on a per sq. ft. basis.

Buildings: Costs are generally based on the type of construction to be used and the number of floors. The cost determined as an amount per sq. ft. multiplied by the floor area and by a factor for the number of floors.

Electrical work: If electrical equipment is vapor-proof or explosion-proof, specifications must be carefully surveyed. Cost of such equipment may exceed normal types by several hundred percent.

Painting: Specifications should be consulted again to find the number and types of coats to be applied. Structures and vessels exposed to the weather may be sprayed while interiors of buildings probably require brush application, involving a greater labor factor.

Engineering and drafting: The cost may be estimated as a percentage of the total cost—around 5 percent.

Miscellaneous: The estimate must include all items necessary for the operation of the unit. This includes such things as office furnishings, laboratory facilities, royalties, charges of foreign materials (catalyst, acid, solvent, etc.), waste disposal facilities.

Overhead: Cost will naturally vary from plant to plant and should be obtained from the accounting depart-

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QED, cont. . .

ment. In lieu of any information, a reasonable figure would be 15 percent.

Contingencies: Over and above all estimated costs should be added a contingency item to cover unpredictable factors such as inflation, destruction of equipment or material, underestimation of costs due to omission, etc.

Final step is to assemble the calculations for summation; then recheck for omissions. Should the final estimate be disapproved and at some later date be reconsidered, then the estimate should be reviewed in the light of new costs.

Experience, the best teacher, is of no value unless the results of the cost estimate are compared with the actual cost of the completed job. This information should be available to the estimator if he is expected to do a good or better job in the future.

R. P. Wilson, Mid-Continent Petroleum Corp., before the Petroleum Mechanical Engineering Conference, Tulsa, Okla., Sept. 24-26.

HUMAN RELATIONS

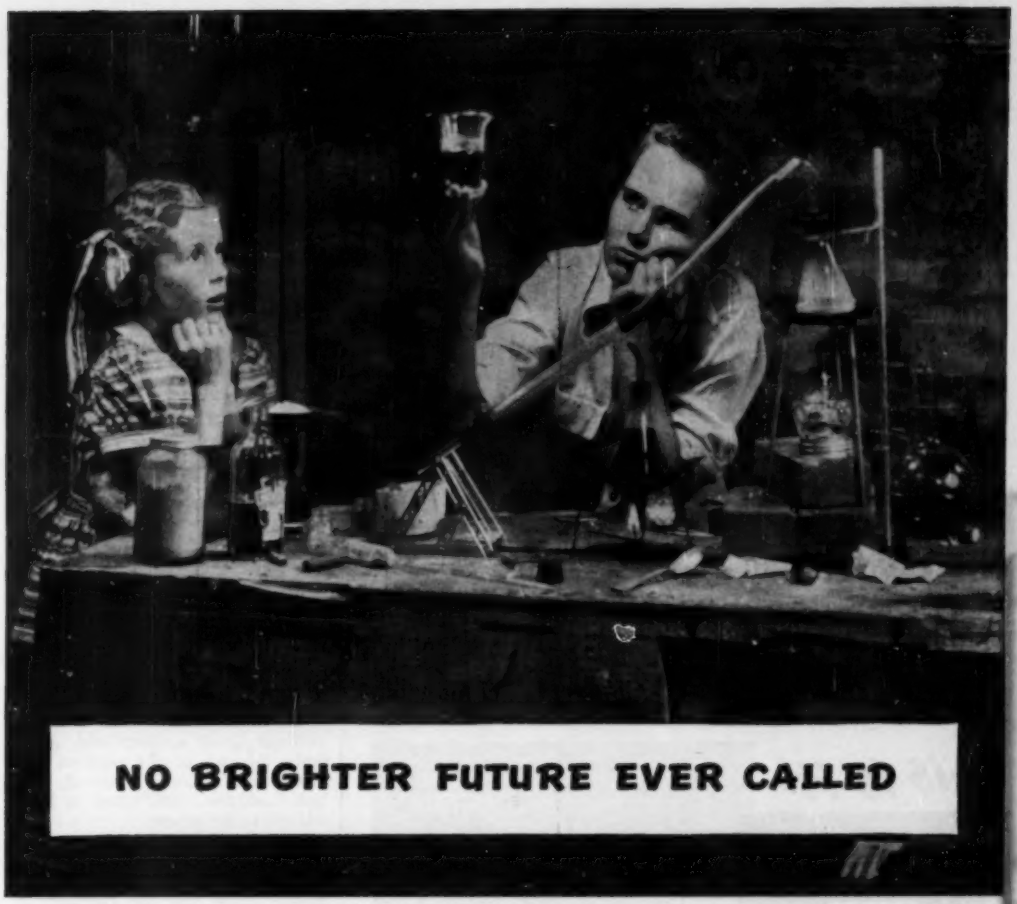
...A Business Problem

G. L. Clements

Currently there is much discussion of communication as a business problem. Unquestionably it is one of the most difficult management problems, and one that every company needs to study constantly. But my feeling is that entirely too much emphasis is being put on words and not enough on humaa warmth in internal communication. One of the greatest needs in every company is more human warmth.

By its nature business is impersonal. Even those people who work in the same offices every day are often so busy and preoccupied that there is little human warmth in their contacts. In our relations with field people, it is particularly hard to keep from being cold and impersonal. We need to get across to our people the important fact that our greatest concern is for their personal success, progress and happiness. We need to feel this, and we need to find ways to show it.

Each of us is a bundle of emotions. Usually we feel before we think. We react to people, problems, letters, rules and regulations, company policies, etc., often with lightning speed —for or against. Our automatic reactions are usually influenced more by the spirit behind these things than by the things themselves. If it is cold and impersonal, our reaction is apt to



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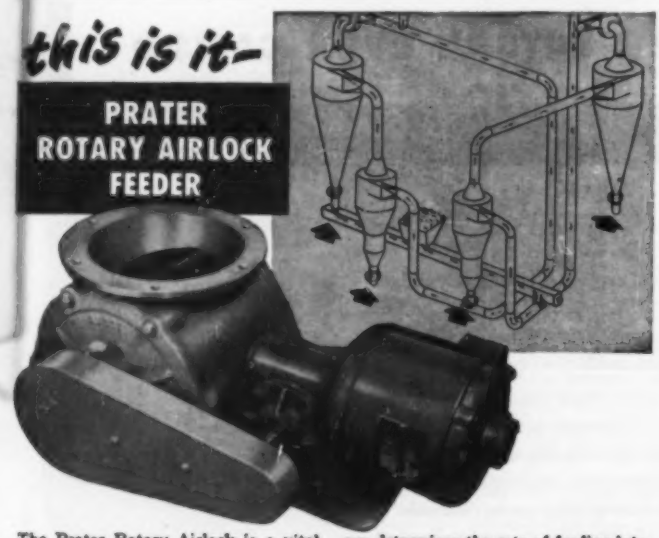

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be coldly critical, perhaps cynical or suspicious. If it is warm and friendly, our reaction is apt to be warm and friendly, too. But the spirit must be genuine; fine words will not serve the purpose. People are everlastingly questioning the words they read or hear to find the spirit behind them.

G. L. Clements, Jewel Tea Co., Inc., before the American Management Assn., Feb. 28, 1951.

POLLUTION

. . . Community Relations

R. J. Buckley

Air pollution presents two distinct sets of problems—those of an engineering nature and those dealing with community relations. Methods of abatement are almost entirely engineering problems. The reason for abatement is almost entirely the community relations problems engendered by pollution.

The first requirement of a sound community relations program for any company is that the company must live right and must act in good faith, not only in dealing with problems of air pollution but in every phase of its business conduct. This is basic. Without good conduct and good faith, the rest of the program, no matter how skillfully conceived, will lack foundations and sooner or later will fall to the ground.

Informing the Community—Assuming that this basic requirement is met, the next step is to let the community know that the company is acting in good faith and to seek community understanding of the company's problems and actions.

Employees are the most important single group. If they are against the company, it cannot hope to gain the confidence of the rest of the community. If they are for the company, they will be the most effective agents in its community relations program, carrying the company's campaign to their friends and neighbors.

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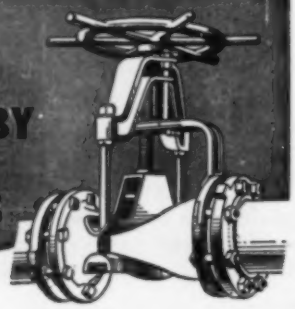

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QED, cont. . .

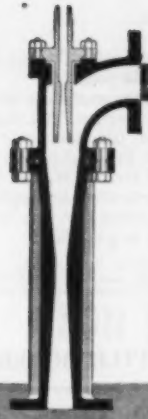
Neighbors—Turning to the second important group, neighbors, it is readily apparent that the starting point must be sound employee relations since the employee and neighbor groups are found to be somewhat overlapping.

Plant Visits—An effective method of telling the company story to neighbors and employees alike is a series of conducted plant visits for employees' families, neighbors and the thought leaders of the community—clergymen, educators and newspaper editors.

The Press—The written word, through the medium of the local press, is perhaps the most important medium of day-to-day communication with the plant community. Because each industrial plant is an element in the local economy and many plant employees are readers of the local newspaper. Newspapers have a legitimate interest in plant news. While management should be conservative in seeking publicity, it should realize that the public, through the medium of newspapers, has a right to certain information and that it is to the company's advantage to see that legitimate information is made available promptly, accurately, and completely, when it is requested.

Clubs and Civic Organizations—Next to newspapers, one of the best means of communication with neighbors is realized through talks before local civic organizations, service clubs, and women's clubs. These organizations usually are eager to obtain speakers, and their members are eager for information (particularly on a subject such as air pollution) that is of such intimate concern to all of the members.

Public Officials—Cooperation with public officials charged with enforcement of anti-pollution laws is an essential part of the community relations program. Most officials are reasonable and are anxious to cooperate with any company that is making a sincere effort to comply with the law. The enforcement agency frequently is under pressure from civic organizations, the press and the general public to put an end to pollution. This pressure may force the agency to take legal action against, or at least to cast blame upon, a company that has failed to cooperate with it, regardless of the status of the company's pollution abatement program. In other words, it is not enough that a company have a sound program in effect. It must also keep the enforcement agencies supplied with detailed information regarding the program, so that the agencies may defend them-



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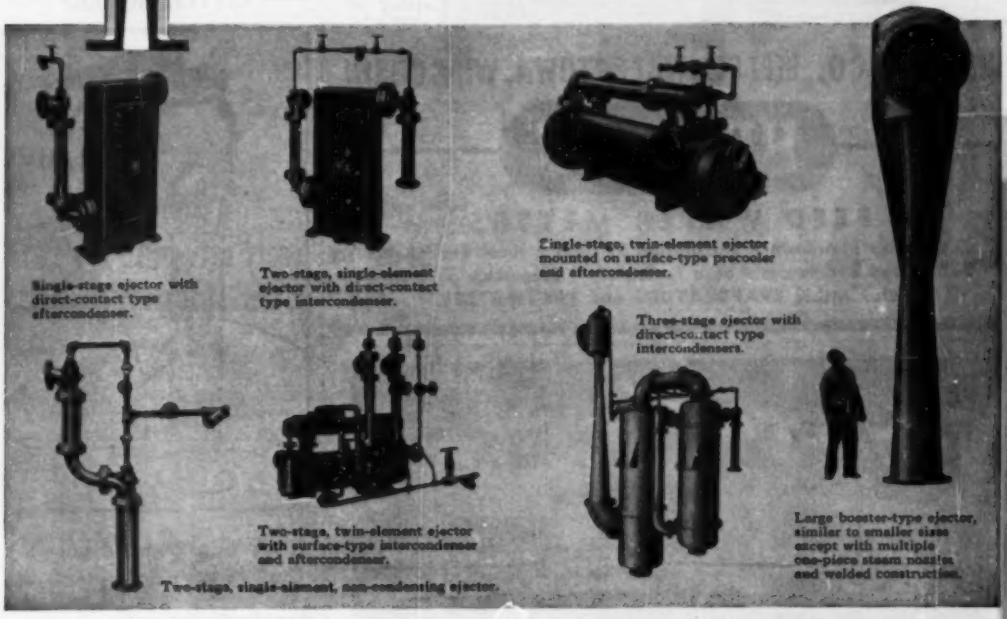

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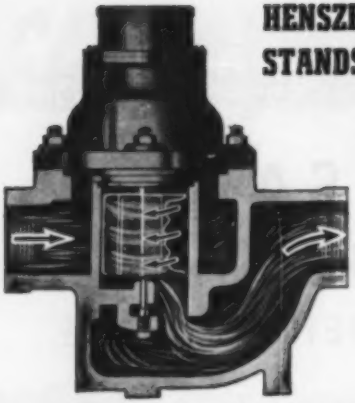

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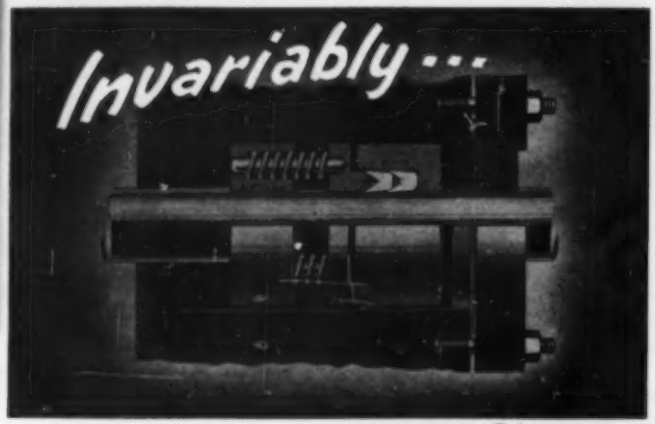

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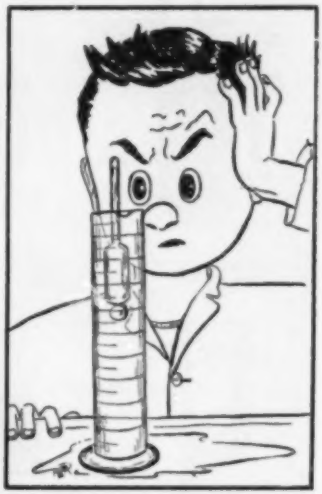
QED, cont. . .

selves, and, incidentally, the company, against public pressure.

Good faith, after all is the basis of the entire program. A company will enjoy good community relations as long as it lives right, acts in good faith, and sees to it that the community, particularly its employees and neighbors, know that it is living right and acting in good faith.

R. J. Buckley, "Community Relations," Air Pollution Abatement Manual, Manufacturing Chemists Association, Washington, D. C.

LITTLE BONERS



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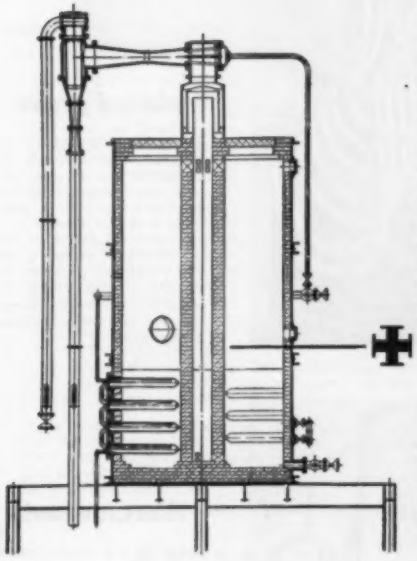

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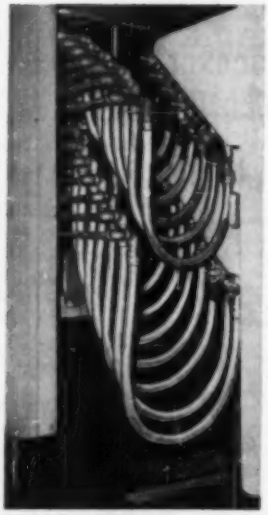

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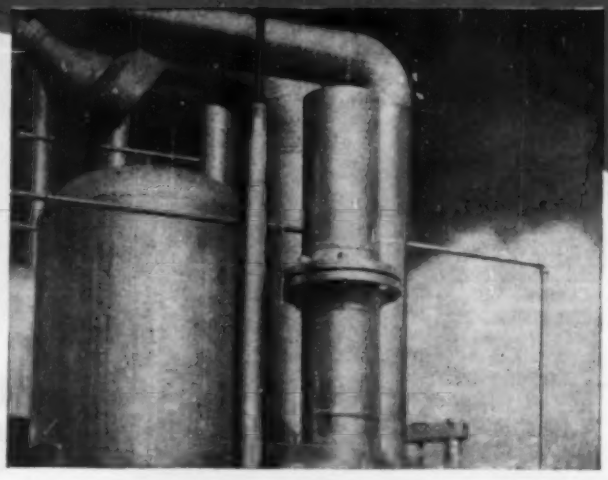

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Chemical Engineer's Bookshelf

Edited by Lester B. Pope

Fundamentals

TEXTBOOK OF ELECTROCHEMISTRY, VOL. I. By G. Kortüm and J. O'M. Bockris. Elsevier Press, Houston. $7.

Reviewed by Henry C. Miller

This English edition of Kortüm's book stresses a clear understanding of fundamentals. To this end, more than a hundred pages are devoted to the physical, thermodynamic, and chemical principles used in electrochemistry. After these fundamentals come chapters on weak and strong electrolytes, potentiometric measurements, interionic attraction, conductance, electromotive force, and equilibria in solutions of weak electrolytes. The sections on types of conductors, pH, and protolysis are exceptionally good, but those on electromotive force cells and electrode reactions are too brief for clarity, especially so because of the confusion that might result from the use of the European sign convention for electrode potentials.

Industrial applications of electrochemistry are not dealt with at all, while its applications to physicochemical research and to chemical analysis are but briefly illustrated.

With the exception stated above, conventional notation is used through the text, and while European phrasing is apparent at times it does not affect its clarity, indicating that this is not just a translation of the German, but a complete revision. Special consideration is shown the English reader by the large number of English language references in the bibliographies at the end of each section.

This first volume is well bound, and printed in clear type on a good grade of non-glossy paper. The index for the text will be found at the end of Vol. II. The book should prove useful as a general reference text on electrochemistry.

No Theory

STATISTICAL METHODS FOR CHEMISTS. By W. J. Youden. John Wiley & Sons, Inc., New York. 126 pages. $3.

Dr. Youden, now statistician for the National Bureau of Standards, is well known in chemical and chemical engineering circles as a long time member of the staff of Boyce Thompson Institute. Although he was trained initially as a chemical engineer, his later specialty was physical chemistry, so that it is natural that his little book should hold more appeal for the laboratory chemist and analyst than for engineering members of the profession. Nevertheless, for engineers who would understand the significance and interpretation of experimental measurements and data, and would know how experiments should be designed for ready statistical analysis, this short course on the statistical approach is essential reading.

Relatively elementary in its concept, the book largely omits statistical theory, emphasizing instead those statistical methods which the author himself has found most useful in over 20 years of experimentation. He deals at length with such matters as precision and accuracy, comparison of averages and resolution of errors, analysis of variance, interaction of various factors, and selection of experiments with statistical analysis in mind. —*TRO*

Bad News for Bugs

INSECT CONTROL BY CHEMICALS. By A. W. A. Brown. John Wiley & Sons, New York. 817 pages. $12.50.

The whimsical reader of this book is tempted to voice the opinion that in recent years, the insecticides seem to have the same gift of proliferation as the insects they try to bump off.

Seriously, the book is a comprehensive compilation of the chemical, physical and toxicological properties of insecticides.

Properties of the newest, as well as the standard, insecticides are followed by an attempt to correlate the relation between the structure of organic chemicals to their toxicity. The next two chapters deal with the science of poisoning insects.

Equipment for the application of insecticides is treated well, and at some length, includes a separate chapter dealing with dispersion by aircraft.

Of major and timely importance is the section on the toxicity and hazards of insecticides to man and to domestic animals. Data on tolerable and hazardous exposure in the home and in the plant are broken down by chemicals, classes of insecticides and individual insecticides.

Remaining chapters list information to indicate the best insecticides to use against the particular insects which attack plants, animals and man.

The book is, of course, a reference text, and will be most valuable in the field of insect control or on its periphery (aerial crop sprayers, zoologists).

Valuable features are (1) a good index; and (2) a relegation of detail to references—2,300 of them—which provide an exhaustive coverage of the field.—*RVR*

Disarmingly Simple

INDUSTRIAL FURNACES, VOL. I. Fourth edition. By W. Trinks. John Wiley & Sons, New York. 526 pages. $10.

Reviewed by William J. Shore

The following headings, indicate the various aspects of the subject covered: Heating Capacity, Fuel Economy, Heat Saving Appliances, Strength and Durability, Movement of Gases, Temperature Distribution in Solid Bodies, Radiation of Clear Gases, Heat Losses form Walls, Recuperator and Regenerator Calculations. These various classifications indicate that the subject of industrial furnaces is covered completely as well as thoroughly.

Many scientific writers take pleasure apparently, in displaying their vast fund of knowledge. Some of these write exclusively for their confreres and through use of involved phrases, specialized scientific terms—with complex mathematical presentations — please themselves. But readers in search of easily assimilated knowledge and data, become confused and discouraged. This is not so with Professor Trinks' book on furnaces. A person of moderate education can take any portion of this book and can understand what is presented. Its very simplicity is disarming — yet, through it all, the information is accurate, and is based upon factual experience and long time tests of furnace operation and practice. Professor Trinks is not exactly against strict mathematical presentations, but, as he states it:

"For each case an individual set of curves and separate calculations are required. The fact that each calculation requires approximately 100 hr., is, in itself sufficient excuse for limiting . . . work to what has been offered."

Where mathematics is necessary, his formulas are straightforward and

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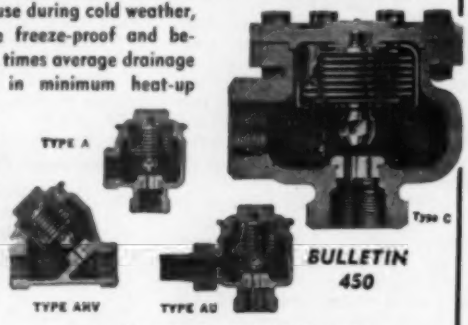

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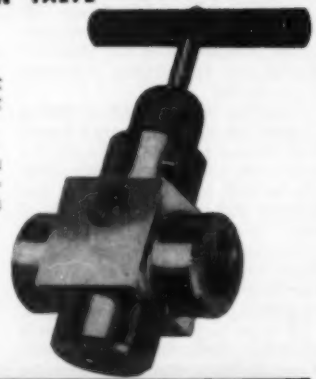

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easy to apply to obtain required data. The work is most interesting. It may be begun at any page, and will provide information of use and real value. This book is highly recommended to those whose work brings them in contact, directly or indirectly with any operations requiring furnaces.

For the Uninitiated

X-RAY ANALYSIS OF CRYSTALS. By J. M. Bijvoert, N. H. Kolkmeyer and Caroline MacGillavry. Interscience Publishers, New York. $6.50.

Reviewed by Joseph S. Lukesh

In recent years, most college curricula in chemistry have included at least the fundamentals of the theory of X-ray diffraction and crystal chemistry. Most chemical engineers have not, however, pursued the subject into the more advanced stages of crystal structure analysis, although much useful information regarding chemical processes may be obtained thereby.

The present volume by Professor Bijvoert and his collaborators, the late N. H. Kolkmeyer and Professor Caroline MacGillavry, provides an excellent introduction into the theory, experimental techniques, analysis of data and interpretation of results. It is written in a simple, easily-read style with mathematical detail confined to appendices. Much credit for the clarity of the English version must go to the translator, Mrs. H. L. Furth.

The book can be conveniently divided into two sections. The first five chapters are concerned with the theory of X-ray diffraction and its application to structure analysis. The reader is led in a logical manner through descriptions of techniques of recording diffraction patterns, methods of analysis of data to actual examples of structure determinations.

The remaining three chapters are devoted to a discussion of the results of X-ray analysis. They include divisions on structure types, physical properties, polymorphism, inorganic and organic groups of compounds. The appendix contains nine sections covering in detail crystal classes, derivation of space groups, Fourier synthesis, electron and neutron diffraction, and many others.

If one wishes to single out any one chapter for special comment, that dealing with the development of Fourier analysis is particularly noteworthy. Most books on X-ray crystallography presuppose an intimate knowledge on the part of the student of the complexities of Fourier series.

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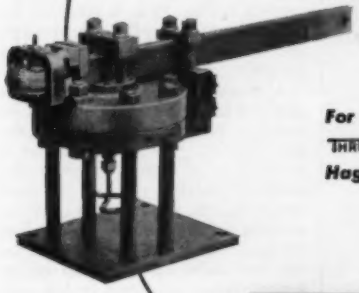

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Indeed, the literature abounds with such phrases as "in the usual manner" or "from this relation it is immediately obvious that—." In the present volume, the subject is developed in a simple, straightforward manner leaving no gaps to be filled in by a search into the literature.

Typographical errors are few with perhaps the most serious being the omission of Fig. 7(a) which is important to the discussion of lattices. Line drawings are excellent and photographs have been chosen with care to illustrate specific points.

Altogether, this is a book to be recommended to the uninitiated who wish to understand the principles of structure analysis or to prepare themselves for more advanced texts.

Silicones

AN INTRODUCTION TO THE CHEMISTRY OF THE SILICONES. Second edition. By Eugene G. Rochow. John Wiley & Sons. 213 pages. $5.

Reviewed by Stuart Canter

Prof. Rochow, a relative newcomer to the ranks of the academician has expanded his original text, spurred to the task by removal of certain restrictions of both a private and public nature, and the plethora of recent publications on the subject. The book's theme is the desire that more work be done on the chemistry of silicones because of the practical uses indicated—which in turn will encourage further fundamental as well as applied research. This view is cheered by this reviewer especially when broadly interpreted and because its tone is definitely unprofessorial.

A demonstration of this thesis is provided in the chapter on molecular structure (one of four added to the first edition). A theory of structure is adduced as a basis for suiting the needs of practical end use. Physical measurements drawn from the researches of many workers in the field are employed to demonstrate that the low intermolecular attraction of organosiloxanes—as shown by low boiling points, low tensile strength of silicone rubber etc.—stems from the character of the siloxane linkage. Relatively free rotation about the Si-O bond prevents close packing of chains and the influence of intermolecular forces as would be the case of a purely covalent system.

The book begins with a recapitulation of the simple covalent compounds of silicon with hydrogen, the halogens and oxygen. How the introduction of

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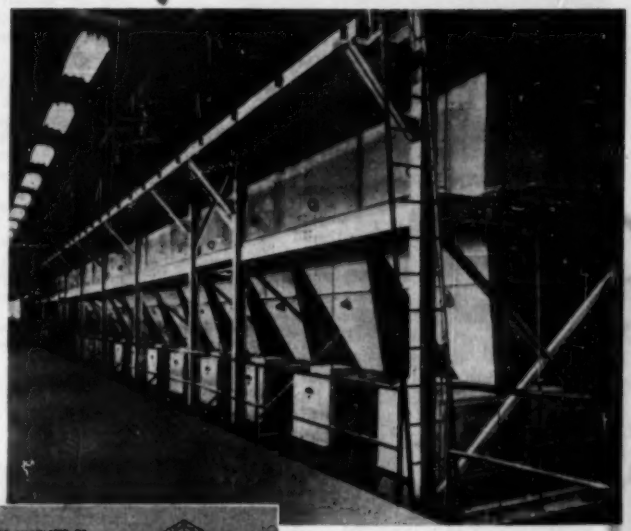

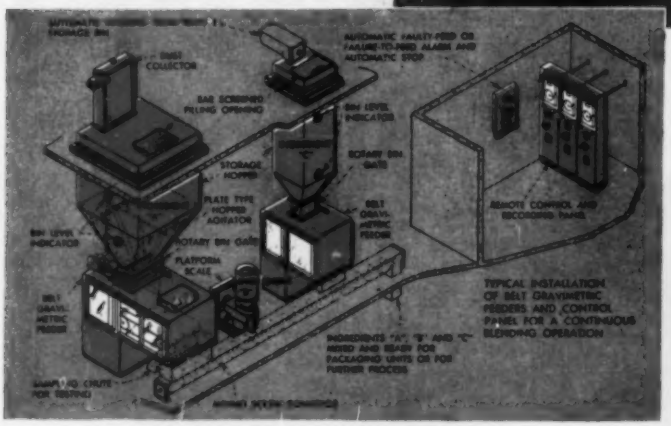
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oxygen into the silane-type structure causes quite a difference in physical properties from carbon analogues is pointed out. Rochow follows up his theoretical discussion of the controlled hydrolysis of silico-halides by describing the application of that phenomenon in stone preservatives and as a hardener for paints and lacquers.

The C-Si bond is then analyzed in the light of its partially ionic character. Placement of groups to enhance or damp its polarity give a good idea of its reactivity. Syntheses of organosilicons are then reviewed.

With the start of the examination of organo-silicon polymers the book picks up speed probably because of the care taken by the author in laying the groundwork of this critique. The synthesized siloxane polymer is compared with natural inorganic silicates. The place of metal ions (to satisfy some oxygen bonds) in the latter is taken by organic groups. The siloxane structure in combination with metal ions shows strength and rigidity, with organic groups softness and flexibility.

Kipping receives his due as the prolific maker and examiner of polyorganosiloxanes. He also gets a gentle reprimand in the not-so-subtle form of the direct quotation indicating his lack of enthusiasm of silicone chemistry. Actually Rochow's effusiveness would be hard to match. The peak of such excitement is graphically illustrated in the space reserved for "Some Production Considerations." Sentences in this section move fast and some periods that close them need exclamation points. Flow sheets for the commercial production (generalized of course) of silicone polymers by one indirect method (use of Grignard reagent) and two direct methods starting with silicon itself are illustrated. The dollars and cents requirements are kept in mind to justify each step. The possibility of toxicity (nil) and the future of the investigations in silicones (apparently rosy) wind up the chapter.

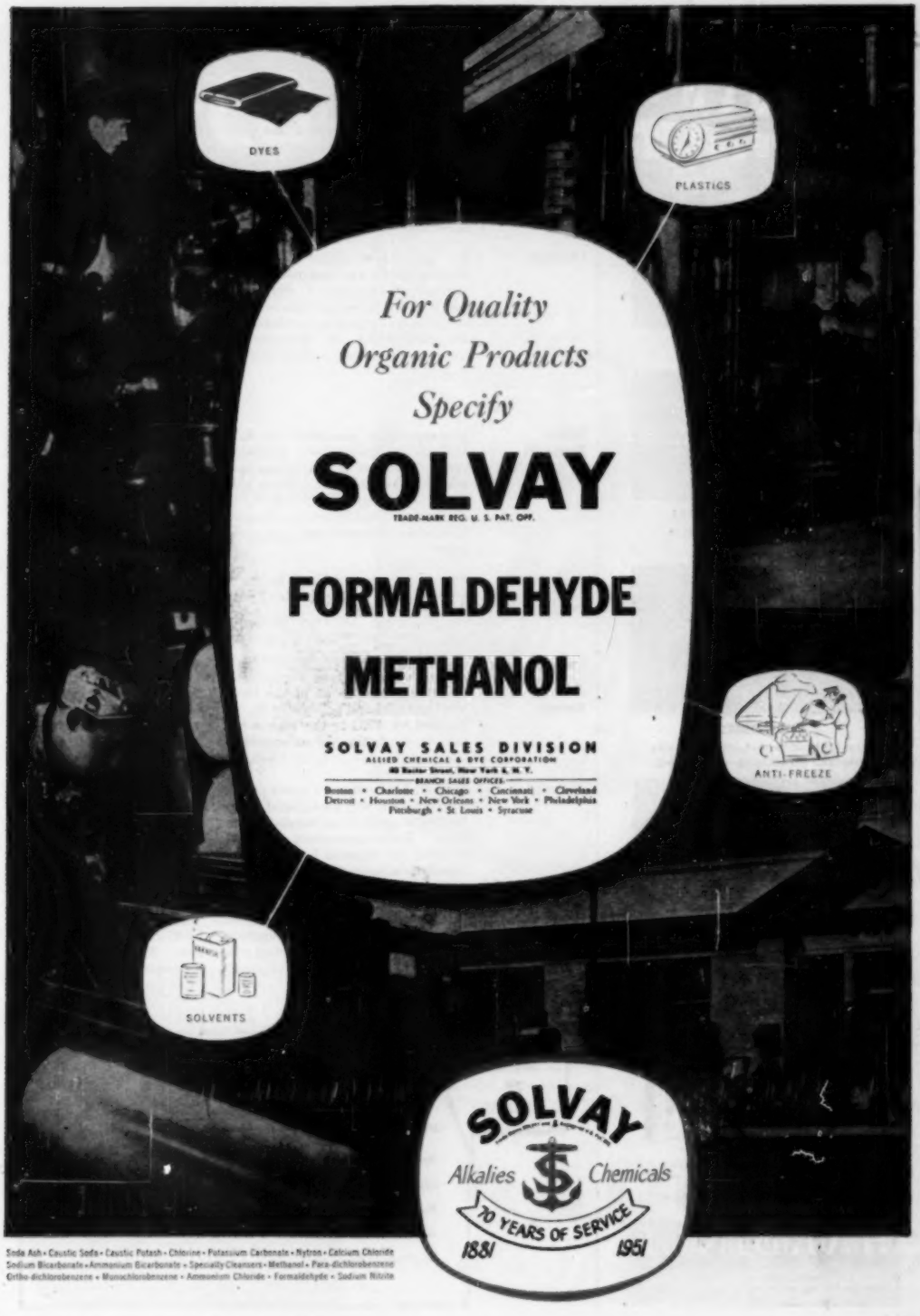
Mention is made of the formulation and properties for industrial use of silicone oils, resins and rubbers. The tailor-making of these polymers is the feature of this perusal. The stability of these compounds to heat, resistance to oxidation and excellent dielectric properties are common traits.

The book ends with a newly included chapter for the student of the subject—"Tables of Physical Properties of Organosilicon Compounds."

This is a good informative book written by the authority on the subject. Enough said.

Recent Books & Pamphlets

Subject	Summary	How to Order
Processing Tools	Trends and developments in equipment and techniques which are of the greatest significance to the process industries. Field is broken down into 14 sections including materials handling, fluids handling, heat transfer, distillation and extraction. 10 pages.	"New & Better Processing Tools Point to Improved Efficiencies and Lower Costs." Reprint No. 183. Editorial Dept., Chemical Engineering, 330 West 42nd St., New York 36, N. Y. 25 cents.
Fission Products	Report to the AEC on technological and economic questions. A potential process using fission product radiations is outlined. Specific uses of fission products suggested during the study are tabulated. 102 pages.	"Industrial Uses of Radioactive Fission Products." Project 361, Stanford Research Institute, Stanford, Calif. $1.50.
Mathematics	Aimed at the engineering student, the book treats those branches of mathematics which he normally encounters in the first year or two following his introductory work in calculus. 640 pages.	"Advanced Engineering Mathematics." By C. R. Wylie, Jr., McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. $7.50.
Waste Disposal	Studies specifically the results of dumping acid waste off the New York Harbor.	"Disposal of Chemical Waste at Sea." By A. C. Redfield and L. A. Walford. Nat'l Research Council Publication 201. National Academy Of Sciences, 2101 Constitution Ave., Washington 25, D. C. $1.
Mineral Wool	Methods for evaluating raw materials for manufacture of mineral wool including typical results obtained by tests on satisfactory present raw materials.	"Raw Materials for the Mineral-Wool Industry." RI 4821, Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa. Gratis.
Electromanganese	Methods recommended from pilot plant studies.	"Semi-Pilot-Plant Investigations on Electrowinning Manganese from Chloride Electrolytes." RI 4817, Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa. Gratis.
Packaging	Manual, based to a large extent on a former Navy publication, is a joint effort by the Departments of the Army, Navy and Air Force.	"Preservation, Packaging and Packing Military Supplies." Navy Publication NAVEXOS P-978. Superintendent of Documents, Washington 25, D. C.
Defense Selling	Concise guide for companies interested in getting defense contracts and subcontracts. 12 pages.	"Six Steps in Selling to the Armed Services." Dept. of Manufacture, c/o R. D. Siverson, Chamber of Commerce of the United States, Washington 6, D. C. 15 cents.
Pollution	Two State-Federal summary reports point out where and why sewage and waste treatment projects are needed in the California and Great Britain Drainage Basins. California report, 90 pages. Great Basin report, 67 pages.	California & Great Basin Drainage Basins Office, 441 Federal Office Bldg., San Francisco 2, Calif.
Standards	List of titles in numerical sequence of all ASTM serial designations, issued as of March 1951. Standards also indexed by subject. 262 pages.	"Index to ASTM Standards, 1950." American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.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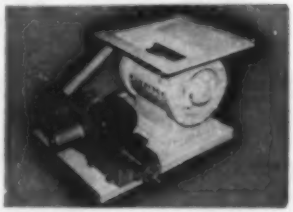

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Oilseeds	For operators of oilseed solvent extraction plants and designers of solvent recovery equipment. Six charts which show technical data on the densities and gravities as related to the composition of mixtures of cottonseed and peanut oils in hexane.	"Densities and Gravities of Cottonseed and Peanut Oil Miscellas in English Units," by K. M. Decossas, F. A. Deckbar and J. L. Hecker. Booklet AIC-292. Southern Regional Research Laboratory, 2100 Robert E. Lee Blvd., New Orleans 19, La. Gratis.
Minor Elements	Key to material published from July 1947 to December 1950. Intended primarily for use of institutions and scientists engaged in agriculture and nutritional research. Contains 1,222 abstracts indexed by author, element, botanical and animal nutrition. 152 pages.	"Bibliography of the Literature on the Minor Elements and Their Relation to Plant and Animal Nutrition." Fourth edition, Vol. II. Chilean Nitrate Educational Bureau, 120 Broadway, New York 5, N. Y.
Agriculture	Summary of patents and technical articles issued during the fiscal year ending June 1950.	"Publications and Patents of Bureau of Agricultural and Industrial Chemistry." By T. D. Jarrell. A. I. B. 37. Department of Agriculture, Washington 25, D. C.
Atomic Energy	Reference index to all of the technical material and policy statements released by AEC in the nine semi-annual reports thus far submitted to Congress.	"Index of AEC's Reports." Superintendent of Documents, Washington 25, D. C. 20 cents.
Pollution	State-Federal summary report points out where and why sewage and waste treatment projects are needed in the basin. Recommendations and conclusions are followed by individual descriptions, supplemented by tables, of the sub-basins. 212 pages.	"Missouri River Drainage Basin." Missouri Drainage Basin Office, 605 Red Cross Bldg., Kansas City, Mo.
Research	Brief descriptions of current research projects, names of faculty members in charge. Chemical engineering and chemistry projects occupy five pages. 85 pages.	"Research at Northwestern." Northwestern University, Rm. 204, Pearsons Hall, Evanston, Ill.

—*End*

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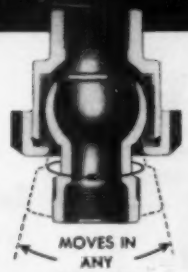

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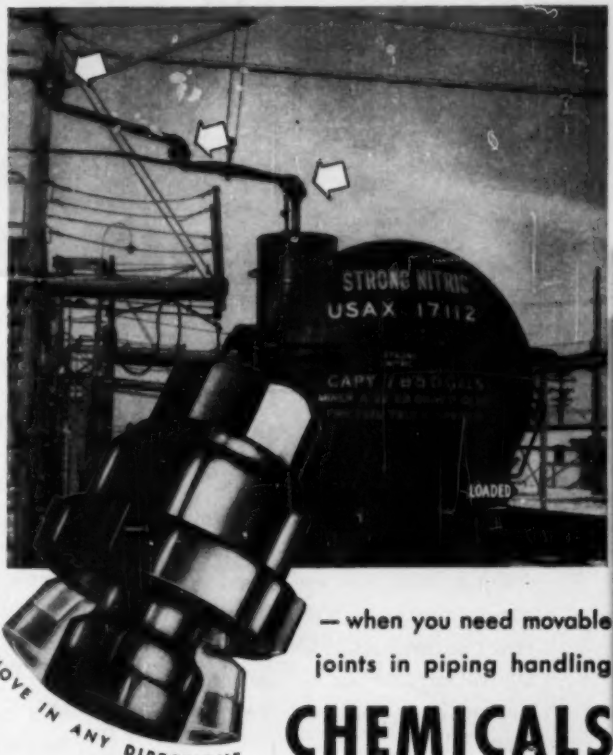

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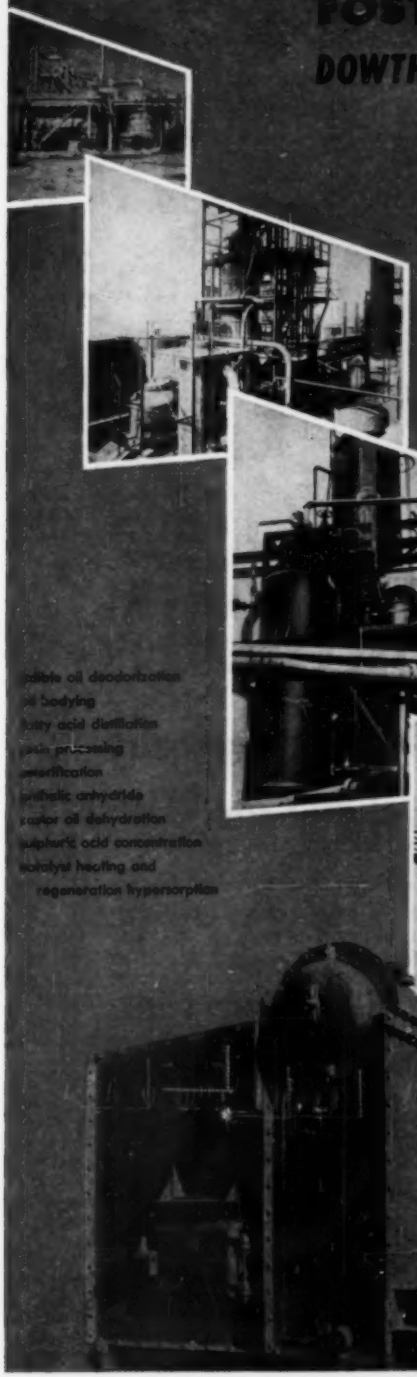

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Hungary	100	88	107	174	---	---
Poland	100	154	305	408	480	---
Argentina	100	229	226	226	248	---
Chile	100	112	116	117	119	127
Japan	100	21	34	48	71	95
India	100	108	154	169	209	---
Canada	100	168	175	175	182	198
United States	100	224	227	215	236	264

World Chemical Race Speeds Up

UN figures, published here for the first time, show world-wide chemical gains. And the free world still outstrips the Curtain countries. In Europe, Britain chalks up big gains.

With good blocking from our allies, American firms are doing most of the ball-carrying as the West strives to outproduce the Communist countries in the vital chemical industry.

And despite production gains behind the Iron Curtain, the free nations have a commanding lead in chemical output.

Aided by United Nations officials, *Chemical Engineering* is now able to use official statistics—never before published—as the basis for a world-wide analysis of chemical output.

Nature of Index: The task of putting a chemical index on a world basis has posed a difficult problem for UN analysts. Statistical techniques varied so widely throughout the world that it was impossible to construct an identical index for each country.

In general, the index covers the production of basic chemicals and fertilizers. In some individual cases it includes either rubber products, petroleum refinery output or glass and rubber products.

United States: The great strides made by American chemical producers have been detailed in these columns over the past year. Both the whopping sums used for capital expenditures as well as the magnificent production record of the industry have been noted.

The UN figures reveal that this country's chemical output more than doubled during the decade 1937-1947. From 1947 until Korea the index hovered around 225. And a year after Korea it was 267 and still climbing.

Europe: Britain, Western Germany and France produce more than 50 percent of the total chemical output in Europe—including both Western Europe and the Russian satellites.

Only Britain, however, has pushed production substantially beyond 1937 levels—although all three nations show gains since Korea.

The striking fact about European chemical production is that—with the notable exception of Britain—those nations where the index shot up the most are the ones that had very modest industry installations in 1937. Consequently, the physical increase in output is not quite so startling as the steeply rising index would seem to indicate.

In 1950 all of Europe—east and west—produced 8.1 million tons of sulphuric acid. During that year, the United States was able to produce 12.1 million tons.

United States production of 2.2 million tons of caustic soda in 1950 was more than twice the combined effort of all European countries. And United States output of 3.3 million tons of soda ash exceeded by a million tons last year's all-European production.

U.S.S.R.: The UN couldn't obtain enough information on the Russian chemical industry to set up an accurate index. However, it is clear that Soviet production has made rapid strides and is rolling along at record levels.

In 1938—the last year for which accurate figures on Soviet chemical output are available—the Russians produced 532,000 tons of soda ash. By 1942 Soviet chemical plants had boosted output 237 percent over the 1938 level. This would have placed the production of soda ash at well over a million tons. If Soviet production of ash kept pace with gains in other fields it is likely that Russia now produces about one half the soda ash that this nation turns out.

Russia produced 996,000 tons of sulphuric acid in 1935. Even if Soviet production of this vital chemical jumped ahead far more rapidly than the output of other chemicals, or industry in general, it is nearly inconceivable that the USSR could produce even half so much of this acid as the United States.

Russian Satellites: Poland has made considerable strides in chemical production. In 1950 that country supplied 12.5 percent of Europe's chemicals. In fact, Polish chemical production was second in Europe only to Britain and Western Germany.

Hungary and Czechoslovakia—despite the impressive gains shown in

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the table—together only supply 6.1 percent of total European chemical output. And though figures from Communist China are rare and meager, it is known that in March 1950, only 41 percent of the chemical installations in Shanghai were operating.

The Score: What conclusions can we draw from these UN studies. For the chemical industries, three important points stand out:

- United States production alone far exceeds the chemical output of all the Iron Curtain countries. And it is not likely that the Russians will be able to whittle down this lead.
- As mobilization really takes hold in Europe, it will be necessary for the various nations to continue boosting chemical output. Otherwise the civilian sectors of their economies will be subjected to nearly unbearable stresses.
- The United States will be called upon to help. American chemical firms will have to supply know-how to companies abroad. And a good slice of future economic aid to Europe will be used to increase the supply of American chemicals going to that area as well as to help European chemical production spurt forward.

What's Happening To Rayon

Rayon stocks reached extremely high levels (83.4 million pounds) in October. Stocks in hands of producers were equal to slightly more than one month's shipments. At the same time shipments fell off sharply—to only 81.6 million pounds.

How did the rayon industry get on this spot? Rayon output has been running at peak levels. But with demand in the textile industry low, shipments started to fall in August. For the third quarter, they were at the lowest quarterly level since 1949. Mills were shipping only 80% of their output in September and October.

However one type of rayon, viscose high tenacity yarn, has continued in heavy demand, partly for defense uses. Shipments have continued high—and stocks are low, offsetting some of the losses shown by other types of rayon.

By early next year, the whole industry expects a pick-up. Consumer buying—and reviving interest among retailers — will cut manufacturers' stocks and start shipments upward again by spring. —*End*

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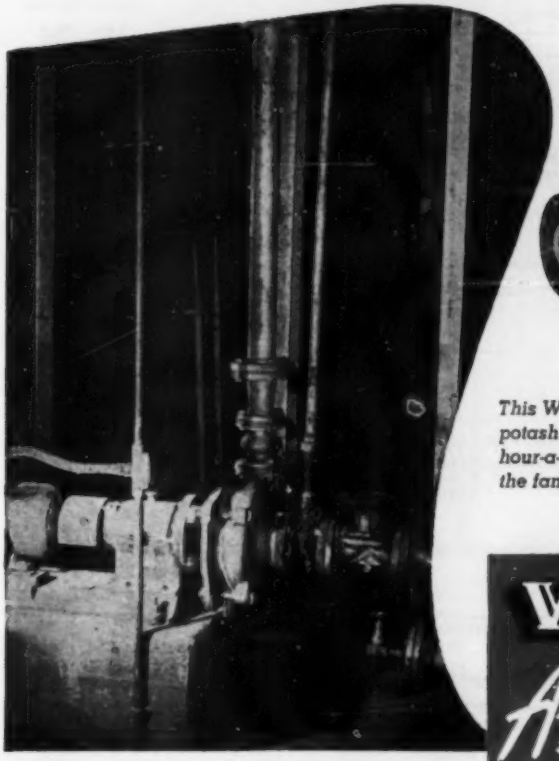

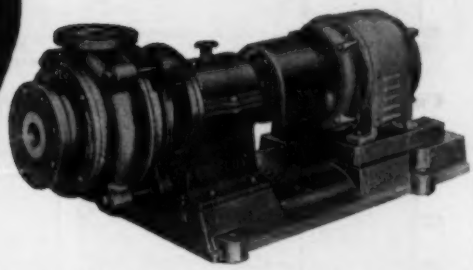

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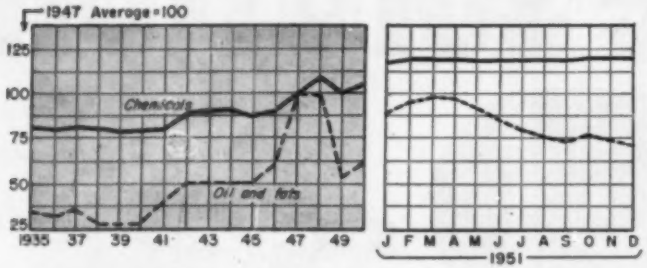
Process Industry Trends

PRICES

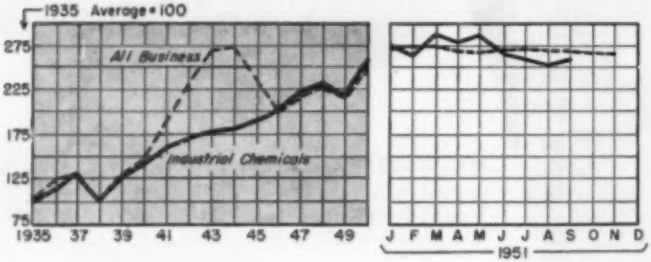


Chemical Engineering's Price Indexes

Chemicals – Up +0.9%
Oils & Fats – Down –4.2%

	Chemicals	Oils & Fats
As of Dec. 1	120.94	71.12
Last month	119.92	74.24
December, 1950	115.94	82.77
December, 1949	99.24	47.93

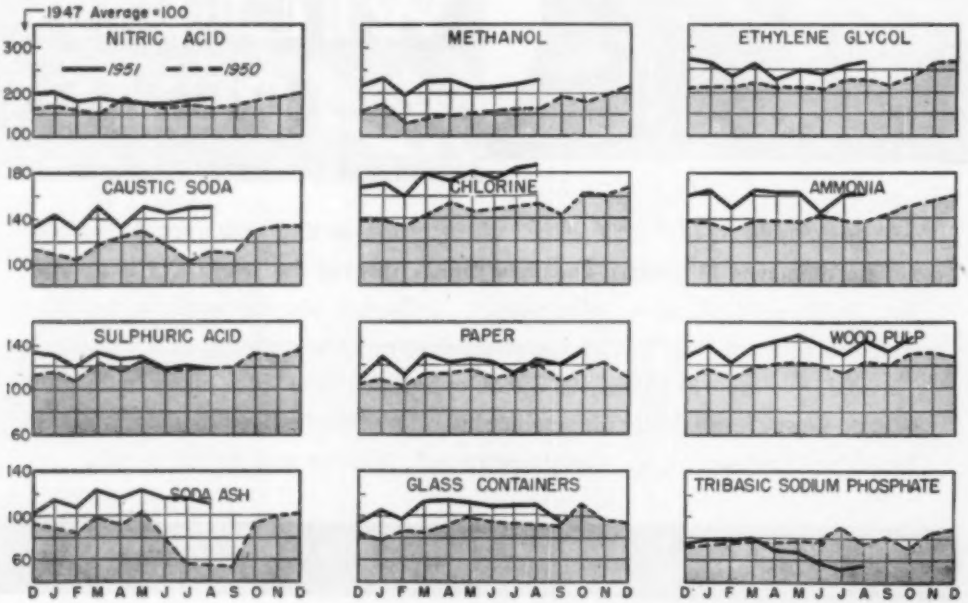
CONSUMPTION



Industrial Chemicals Index

	Oct. (Est.)	Sept. (Prelim.)	Aug. (Revised)
INDEX	257.00	252.89	269.30
Fertilizers		48.74	50.78
Pulp and paper		27.96	30.46
Petroleum refining		25.69	26.41
Iron and Steel		15.87	16.00
Rayon		29.60	33.27
Glass		21.44	24.04
Paint and varnish		26.54	28.23
Textiles		9.65	11.35
Coal products		11.23	11.46
Leather		3.90	3.90
Explosives		9.07	9.44
Rubber		6.35	6.33
Plastics		18.95	17.63

PRODUCTION



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● Under present conditions we cannot always give you all the materials you require. But we can give you plenty of help through Revere's Technical Advisory Service. And, our colleagues in American business tell us it's a worthwhile aid, too. We have been rendering this service for many years, and it is backed by a wealth of knowledge accumulated over a century and a half of working with metals.

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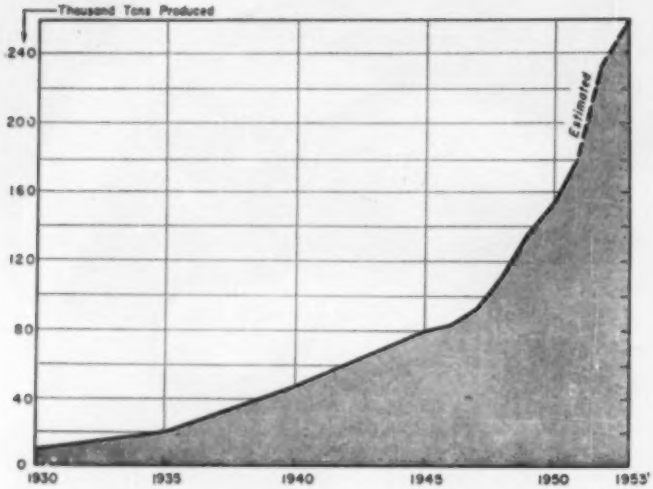

Phosphorus: On The Rise

New and expanded uses have caused an abrupt rise in production. In the next few years the climb may be even steeper. Cost differentials in phosphoric acid are narrowing.

W. H. Waggaman, *a recognized authority on the phosphorus industry, is now with the Defense Production Administration.*

Less than 40 years ago the annual output of elemental phosphorus was only about 650 tons produced in one or more small electric furnaces at Niagara Falls. Today there are 25 electric furnaces manufacturing this element, with a total rated capacity of more than 180,000 tons per year. And if we consider the additional furnaces projected or already under construction, our annual phosphorus capacity in 1953 should be over 260,000 tons.

In the early days, the "strike anywhere" match was the main outlet for elemental phosphorus. Later, when the manufacture of such matches was banned because of the menace to the health of factory workers, the safety match was introduced.

Uses for phosphorus obviously were limited. Then its military value was demonstrated. During World War I phosphorus was an effective weapon. In World War II it played an important role as an incendiary and a producer of smoke screens. It was also used in tracer bullets.

In time of peace, however, elemental phosphorus itself has very few industrial applications. Were it not for its compounds and derivatives, the annual demand could be measured in hundreds, instead of hundreds of thousands of tons.

Expansion: The phenomenal expansion of the elemental phosphorus industry is due to three factors:

- The development of practical methods of producing relatively pure concentrated phosphoric acid from phosphorous.
- The successful use of relatively low grade phosphate rock in manufacturing phosphorus by the thermal reduction process.
- The economies of shipping phosphorus in a concentrated form rather than as phosphoric acid.

Derivatives: Phosphorus is chiefly an intermediate: from it is derived a variety of useful compounds. The most important of these is phosphoric acid, which in turn, is the source of the great family of phosphate salts.

New and expanded uses for phosphoric acid and its end-products have developed greatly within the past decade. For example, the family of calcium phosphates is largely responsible for our fertilizer industry. Monocalcium phosphate and related products are the basis of many baking powders and the leavening agents in self-rising flour. The demand for dicalcium phosphate as an animal feed supplement has greatly increased. Pure tricalcium phosphate is being used more and more as a mild abrasive in dentifrices and as a conditioner for salt and sugar.

Ammonium phosphates, because of their high plant food content (carrying both nitrogen and phosphoric acid) also are becoming increasingly popular in concentrated fertilizers. They are employed, too, as flame retardants for wood and textiles, and in fermentation and yeast culture.

In recent years, however, the greatest use of phosphoric acid has been for the manufacture of its sodium salts. Disodium phosphate, trisodium phosphate, sodium metaphosphate, tetrasodium phosphate and sodium polyphosphate are becoming increasingly important.

They are used as detergents, soap builders, in treating boiler water, in the textile industries and in oil well drilling muds. Our defense program has contributed somewhat to this demand, but normal industrial needs are largely responsible for this expansion.

Raw Material: In the production of elemental phosphorus from phosphate rock by the thermal reduction process, a siliceous flux is added. If high grade phosphate rock low in silica is employed, additional silica must be added.

Most of the high grade phosphate rock in Florida and Tennessee is produced by washing, screening and flotation methods: Chief object is to remove silica. Obviously, natural phosphate deposits containing calcium phosphate and silica in the right proportions, or capable of being adjusted to the proper composition, are more economical to employ than such high grade phosphate rock: Silica must again be added to obtain a suitable charge.

The thermal reduction method does not require the costly concentration steps needed to produce high grade phosphate rock. It has made practicable the use of phosphate deposits that are not amenable to concentration. The phosphate resources of this country thus have been greatly increased.

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NORDSTROM VALVES are particularly applicable to chemical services by reason of their inherent design and ability to resist attacks of corrosion and erosion. The tapered plug is never separated from its seat. The seat is never exposed to the line. Pressurized lubricant provides an effective seal around each port and permits jacking of the plug. Nordstrom engineers have developed designs to fit each chemical need, for pressures from vacuum to 15,000-lb test. For extremely severe services, Merchrome coated valves are available which insure greatest internal protection against corrosion, erosion, high temperature and galling.

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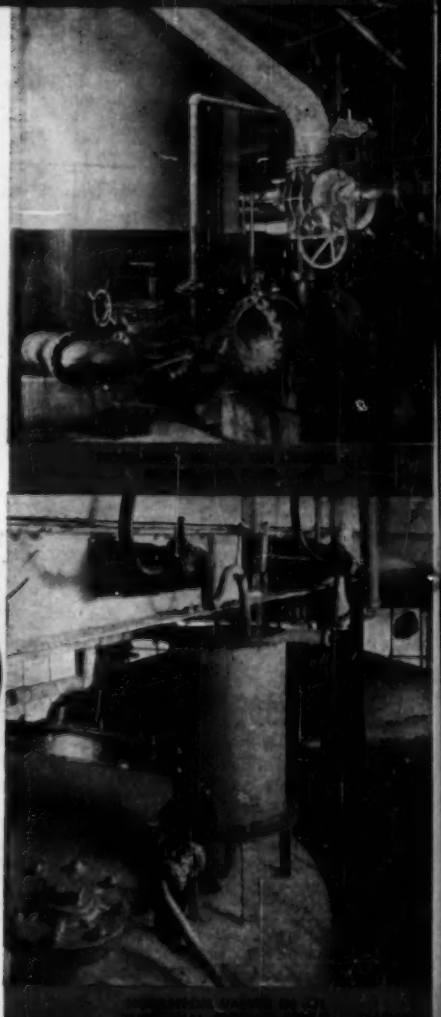

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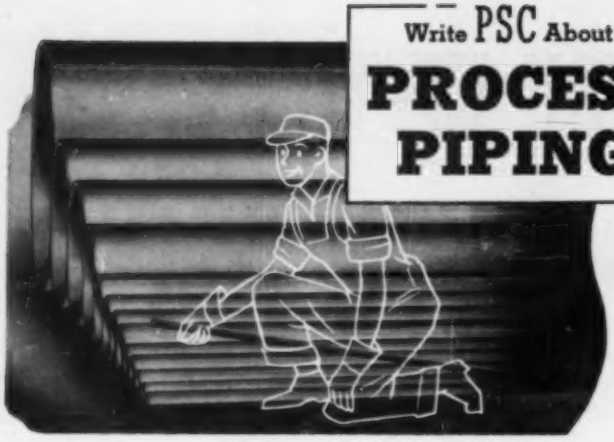

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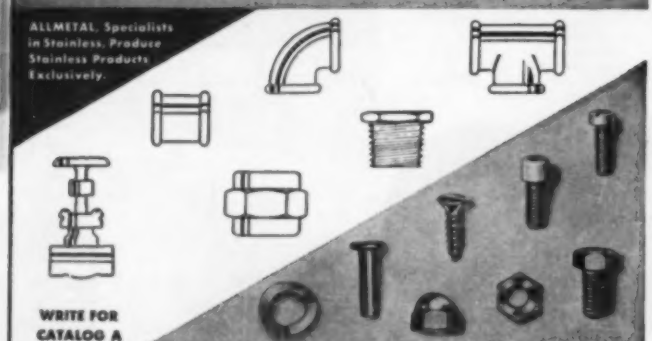

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Old and New: The oldest method of making phosphoric acid consists in treating phosphate rock with sulphuric acid, filtering off the gypsum and insoluble residue and concentrating the filtrate of crude, relatively dilute phosphoric acid.

The question of which is the cheaper method of producing phosphoric acid depends on the following factors:

- Relative price of electric power and sulphuric acid;
- Relative cost of phosphate rock used;
- Relative cost of the two types of plants;
- End use of the phosphoric acid.

Cost of both electric power and sulphuric acid vary greatly from place to place. Large blocks of hydroelectric energy may cost less than 3 mills per kwh. in certain parts of the country, while steam-generated power will cost over twice as much. On the other hand, the cost of manufacturing sulphuric acid as a byproduct of smelting plants is very low compared to manufacturing from elemental sulphur transported from a long distance.

Waggaman and Bell have computed the equivalent costs of these two forms of energy per unit of phosphoric acid produced. As a specific example, they figure that sulphuric acid (100 percent H_2SO_4) at $11.00 per ton is economically equivalent to electric power at 4 mills per kwh.

In the two processes, the cost of the phosphate rock employed may also vary greatly. Only relatively high grade phosphate rock can be economically employed in producing phosphoric acid by the sulphuric acid process. Such rock costs more than certain lower grade rock suitable for treatment in the electric furnace.

On the other hand, the lower grade rock usually must be sintered, nodulized or briquetted before being charged into the electric furnace. This offsets in part its lower initial cost.

Capital cost per ton of phosphoric acid capacity is fully twice as great for an electric furnace as for a wet process plant. But in the wet process a somewhat dilute impure acid is produced,

Phosphorus Production

Producers	Tons per year*
Monsanto Chemical Co.	40,000
Victor Chemical Works	45,000
Westvaco Chemical Division	20,000
Virginia-Carolina Chemical Co.	14,000
Oldbury Electro-Chemical Co.	6,000
American Agricultural Chemical Co.	3,500
Total	158,500

* Approximate capacities, and includes announced expansions during 1951. Compiled by Christian H. Aall, assistant director of research, Monsanto Chemical Co., Columbia, Tenn.

while in the electric furnace plant relatively pure phosphoric acid of any desired concentration can be obtained.

The end use of the phosphoric acid largely governs the type of process employed. Where relatively pure phosphoric acid is desired, the electric furnace process is superior. But where the end product is fertilizer, which does not require the use of pure phosphoric acid, the wet process is still considered the most economical. Moreover, the fact that uranium can be recovered as a byproduct has given an added impetus to this method.

What's Ahead: If phosphoric acid can be made by the thermal reduction process at a price permitting its use in the manufacture of fertilizers, there will be an enormous increase in the number of phosphorus furnaces.

Fluorine may be a potential byproduct. In preparing the phosphate charge for furnace treatment much of the fluorine in the phosphate rock is evolved. Apparently this fluorine is in the form of hydrofluoric acid.

Certain phosphatic shales in the Western states also contain substantial quantities of vanadium. Research investigations by the Bureau of Mines show the bulk of this vanadium is concentrated in the ferro-phosphorus obtained from smelting the shales. Methods of recovery are being studied. They may well lead to further economies in the manufacture of elemental phosphorus.

Bulk of the phosphorus produced is converted into phosphoric acid. This means much of the heat energy consumed in reducing the phosphate rock is released in the oxidation of phosphorus. Because of the corrosive nature of the acid, no efficient method has so far been developed to recover the heat or utilize it as an additional source of power.

However, the heat energy of burning sulphur is used for generating steam in the manufacture of sulphuric acid by the catalytic process. Therefore it is expected that the same principle can be successfully applied to the oxidation of phosphorus. Of course similar precautions must be taken to guard against corrosion of the heat regenerative equipment.

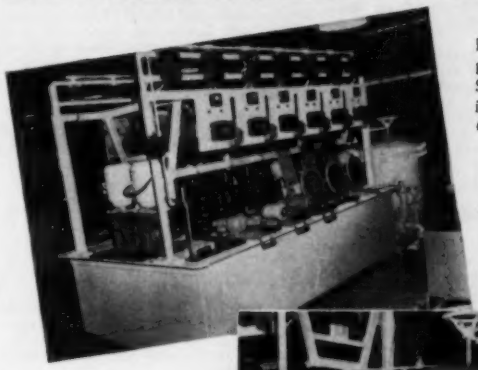
The rise in the price of sulphuric acid has already brought the cost of producing phosphoric acid by the thermal reduction method closer to that of the sulphuric acid process. As some of the economic problems in the thermal reduction process are solved, the gap between the two should be further reduced.

There is little question that the demand for pure concentrated phosphoric acid will continue to grow, thus insuring a steady growth of the phosphorus industry.

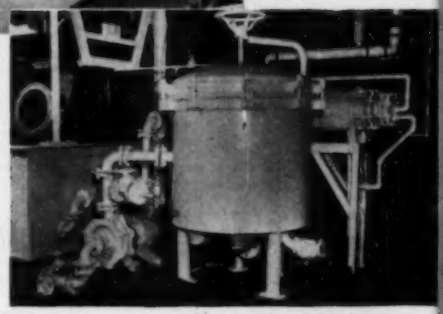
BETTER MUSIC

with an assist from

SPARKLER FILTERS



High-speed copper plating equipment and Sparkler filter installed in RCA Victor plant at Canonsburg, Pa.



Close-up of Sparkler installation with heat exchanger behind filter and pump and motor at left of filter.

Sparkler filters installed in the Radio Corporation of America's phonograph record plants are one of the reasons why all RCA Victor recordings so faithfully reproduce the tone and quality of the original sound.

Here's why: One of the initial steps in this manufacturing process is the production of a large number of molding dies. The first die is made by electroforming an exact negative of the original soft lacquer recording; then, other electroforming operations produce the additional dies needed.

Since the smoothness of the grooved surfaces is one of the factors that determine the amount of noise produced by the record when played, and since any foreign particles in the plating solutions will introduce roughness into the electroformed parts, it is obvious that extremely clean nickel and copper plating solutions must be obtained.

Sparkler handles this job easily, because the horizontal plate principle is especially designed to provide finest quality filtration under all types of operating conditions. Operators know that there is never any variation in quality with a Sparkler filter, even under fluctuating pressures or intermittent operation, since filter cakes are built up uniformly on horizontal plates. High flow rates, easy cleaning, complete portability, extremely low maintenance and operating costs, and minimum "down-time" — are other Sparkler features "tailor-made" for the plating industry.

Contact your Sparkler representative today, or write Mr. Eric Anderson for full information or engineering assistance.

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New Construction

	Current Projects		Cumulative 1951	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$1,100,000	$2,382,000	$12,546,000
Middle Atlantic	.....	10,650,000	34,850,000	87,252,000
South	.....	26,385,000	291,490,000	420,097,000
Middle West	$87,500,000	7,432,000	477,458,000	167,272,000
West of Mississippi	22,500,000	63,383,000	333,247,000	567,914,000
Far West	18,000,000	2,100,000	86,581,000	74,326,000
Canada	.....	.....	229,077,000	164,353,000
Total	$128,000,000	$121,050,000	$1,435,085,000	$1,493,760,000

Proposed Work

Ill., Lockport—The Texas Co., Chrysler Bldg., New York, N. Y., plans to construct a petroleum refinery. Estimated cost $45,000,000

Ill., Wood River—Shell Oil Co., H. D. Dale, Refinery Mgr., Wood River, and 50 West 50th St., New York, N. Y., plans to expand its refinery here to increase capacity from 5,040,000 to 7,140,000 gal. per day. Estimated cost $42,500,000

Tex., Houston—Pure Oil Co., First Natl. Bank Bldg., plans to construct a desalting refinery unit and catalytic cracking refinery. Estimated cost $12,500,000 and $10,000,000 respectively.

Wash., Bellingham—Scott Paper Co., Chester, Pa., plans to construct a paper mill here. Estimated cost $18,000,000

Contracts Awarded

Calif., Dominguez—Borden Co., 350 Madison Ave., New York, N. Y., will construct a plant for the manufacture of resorcin, a chemical used in the manufacture of adhesives, hard resins, etc. Work will be done by separate contracts. Estimated cost $600,000

Calif., Richmond—Standard Oil Co. of California, 225 Bush St., San Francisco, has awarded the contract for expanding its alkaline plant to Bechtel Corp., 220 Bush St., San Francisco. Estimated cost $1,500,000

Ill., North Chicago—Abbott Laboratories, 14th St. and Sheridan Rd., has awarded the contract for an anti-biotic laboratory to Carroll Construction Co., 333 North Michigan Ave., Chicago. Estimated cost $600,000

La., Baton Rouge—Consolidated Chemical Industries c/o Chemical Construction Co., contractor, 488 Madison Ave., New York, N. Y., will construct a plant addition here. Estimated cost $3,500,000

La., Franklin—Bay Chemical Co., c/o Rust Engineering Co., contractor, 575 Sixth Ave., Pittsburgh, Pa., will construct a plant here. Estimated cost will exceed $500,000

La., Sterlington—Commercial Solvents Corp. c/o Ford, Bacon & Davis Construction Co. contractor, 805 South Grand St., Monroe, La., will construct plant additions here. Estimated cost $20,000,000

Mass., Cambridge—Boston Woven Hose & Rubber Co., 29 Hampshire St., has awarded the contract for a rubber reclamation plant to Leroy Fox, 88 Broad St., Boston. Estimated cost $1,000,000

Mich., Midland—Dow Chemical Co., Midland, has awarded the contract for a laboratory unit to The Austin Co., 227 Curtis Bldg., Detroit. Estimated cost $900,000

Mich., Mt. Pleasant—Roosevelt Oil & Refining Corp., Mt. Pleasant, has awarded the contract for a toluene and benzine plant to Procon, Inc., 310 South Michigan Ave., Chicago. Estimated cost $2,000,000

Miss., Jackson—Southland Cotton Oil Co., 1000 North Mill St., will construct an addition to its mill. Work will be done by owner. Estimated cost $85,000

Mo., St. Louis—Mallinckrodt Chemical Works, 3600 North 2nd St., has awarded the contract for a 2 story factory addition to Dickie Construction Co., 317 North 11th St.

N. J., Gloucester—Calco Chemical Division of American Cyanamid Co., has awarded the contract for a warehouse and transit shed to H. John Homan, 434 Haddon Ave., Collingswood, N. J. Estimated cost will exceed $250,000

N. J., Princeton—Heyden Chemical Corp., 393 7th Ave., New York, N. Y., has awarded the contract for an addition to plant Bldg. No. 1, to Wortmann & Sons, 109 East 29th St., New York. Estimated cost $400,000

N. C., Asheville—Sayles Biltmore Bleacheries, c/o Fiske-Carter Construction Co., contractor, Masonic Temple Bldg., Greenville, S. C., will construct a plant addition. Estimated cost $500,000

O., Rossford—Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo, has awarded the contract for a factory to A. Bentley & Sons Co., 201 Belmont St., Toledo. Estimated cost $3,700,000; including equipment $14,183,000

O., Toledo—Medusa Portland Cement Co., Midland Bldg., Cleveland, has awarded the contract for six silos to MacDonald Engineering Co., 188 W. Randolph St., Chicago, Ill. Estimated cost $150,000

Okla., Tulsa—Stanolind Oil Co., 1136 North Lewis St., has awarded the contract for a research center to Manhattan Construction Co., Manhattan Bldg., Muskogee. Estimated cost $400,000

Pa., Philadelphia—Gulf Oil Corp., 30th St. and Penrose Ave., has awarded the contract for a 125,000 per stream day atmospheric and vacuum refinery unit to Foster Wheeler Corp., 165 Bway., New York, N. Y.

R. I., East Providence—W. J. Lynch Paint & Varnish Co., Inc., King Philip Rd., has awarded the contract for a plant addition to Dun-Ell Contruction Co., 47 Commonwealth Ave., Boston. Estimated cost $100,000

Tenn., Nashville—Ferro Enamel Corp., Harvard St. and East 56th Sts., Cleveland, O., has awarded the contract for a factory on Culvert St. to Foster & Creighton Co., American Natl. Bank Bldg., Nashville. Estimated cost $800,000

Tex., Clarkwood—Celanese Corp. of America, Clarkwood, has awarded the contract for a laboratory and office building to E. Eisenhauer, 1205 N. Tancahua St., Corpus Christi. Estimated cost $371,000

Tex., Dallas—Lone Star Gas Co., Harwood and Jackson Sts., has awarded the contract for a warehouse to Sachs-Stevens Contruction Co., Wholesale Merchants Bldg., Estimated cost $315,155

Tex., Dallas—Ruberoid Co., Harry's Rd. and Singleton Blvd., will construct a new plant. Work will be done by purchase and hire. Estimated cost $360,000

Tex., Dallas—Trammel Crow, 425 South Field St., has awarded the contract for a factory in the Trinity Industrial area to be leased to Goodrich Rubber Co., to James Stewart & Co., Inc., Employers Insurance Bldg. Estimated cost $685,000

Tex., El Paso—Standard Oil Co. of Texas, El Paso, has awarded the contract for a products storage farm, alkylation unit, gas plant and treating unit, synthetic distillation unit and reduced crude vacuum refinery unit to M. W. Kellogg Co., M Esperson Bldg., Houston. Estimated cost $3,295,000

Tex., Gregory—Reynolds Metals Co., L. A. Amos, Mgr., Hunt Bldg., has awarded the contract for an additional aluminum plant alongside plant now under construction to Henry C. Beck Co., Dallas and H. R. Henderson & Co., Marshall. Estimated cost $45,000,000

Tex., Port Arthur—Pure Oil Co., Smiths Bluff, Port Arthur, has awarded the contract for an alkylation unit, catalytic polymerization unit and fluid catalytic cracking unit to M. W. Kellogg Co., 25 Huntington Ave., Boston, Mass. and Port Arthur. Estimated cost $1,100,000, $875,000 and $1,500,000 respectively.

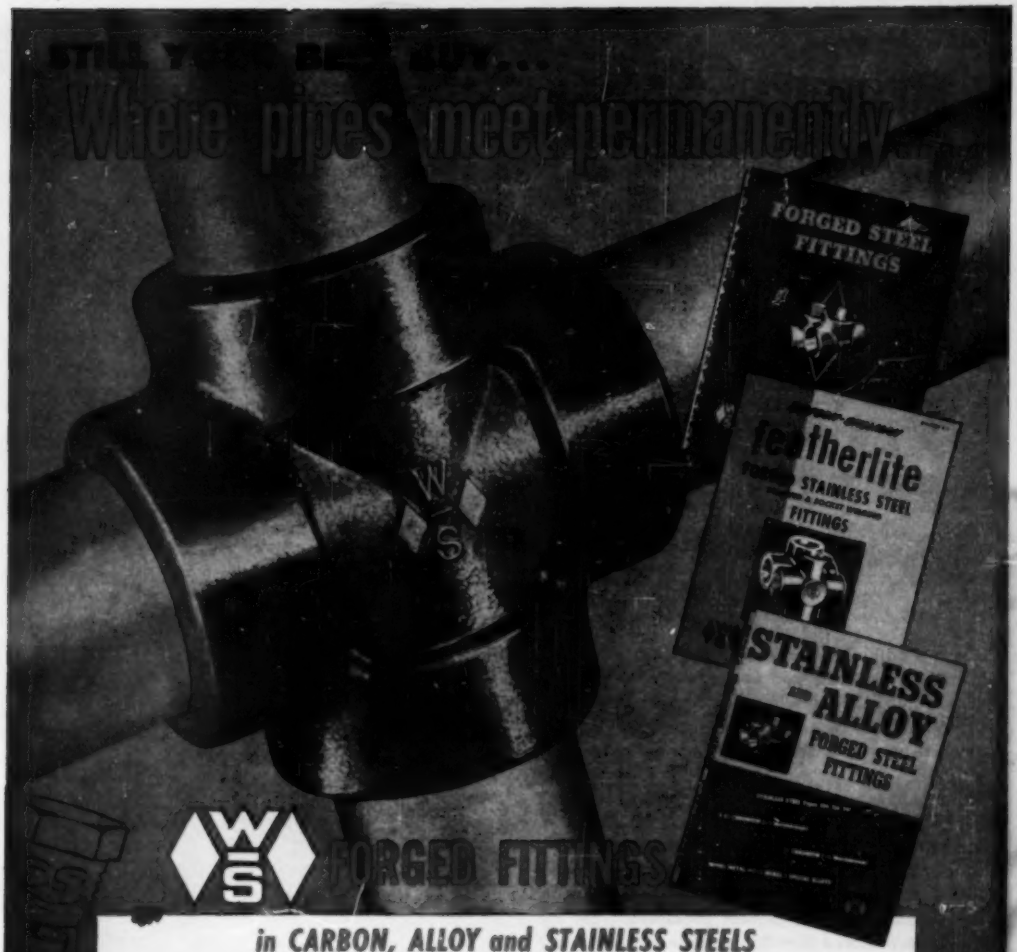
Tex., Synder—Lion Oil Co. and Associated Companies, Synder, will construct a natural gas plant. Work will be done by owners. Estimated cost $7,250,000

Tex., Sundown—Stanolind Oil & Gas Co. & Associates, Fair Bldg., Fort Worth, have awarded the contract for a sulphur recovery processing refinery plant unit to The Fluor Corp., Ltd., 360 East 2nd St., Los Angeles. Estimated cost $1,150,000

Tex., Texas City—Pan-American Refining Co., Texas City, has awarded the contract for a laboratory and office building to Texas Gulf Construction Co., Inc., 2008 South Wayside St., Houston. Estimated cost $1,000,000

W. Va., Institute—Union Carbide & Carbon Corp., 30 East 42nd St., New York, N. Y., has awarded the contract for a coal hydrogenation plant to Ford, Bacon & Davis, 39 Bway., New York, N. Y. Estimated cost $11,000,000

Wis., Sheboygan—Plastics Engineering Co., 1607 Geele Ave., has awarded the contract for a 2 story, 62x108 ft. addition to its factory to Quasius Bros. Inc., 1907 North 15th St.



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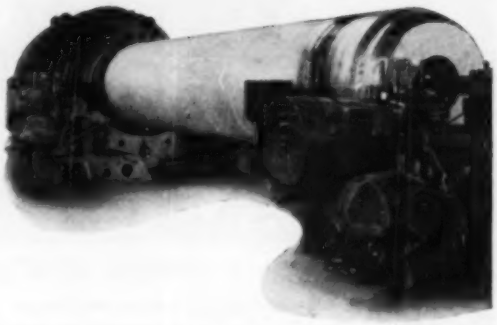

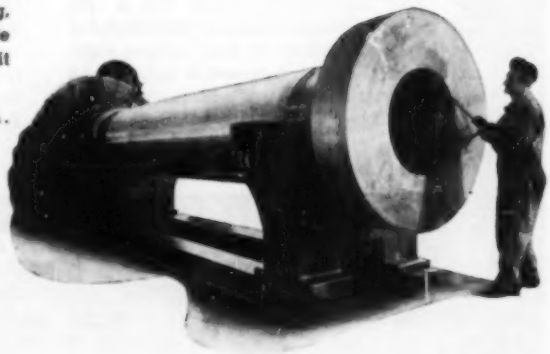

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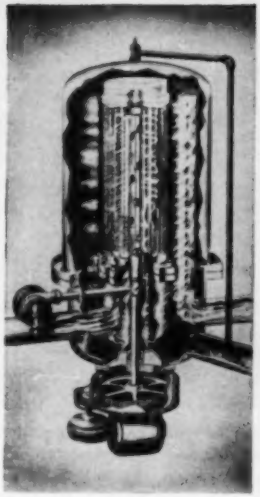
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Clean Raw Water
Reclaim Process Water

with this low-cost non-stop strainer

Abrasion and corrosion-resistant Cuno FLO-KLEAN handles full flow—cleans itself and discharges accumulated trash *without interrupting* flow. Can be installed in some remote place and forgotten. Some users have saved enough to pay cost of FLO-KLEAN in a few months!



CUNO

Fluid Conditioning

Removes More Sizes of Solids from More Kinds of Fluids

Strains fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filters fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Cleans raw water, recirculating water, etc.—FLO-KLEAN

Aid for "Dry" Communities ... Relief from High Water Bills

Many industrial plants have solved the scarce-water problem by using raw river or lake water for plant services.

Passing such water through a Cuno FLO-KLEAN effectively strains out trash and cleans the water at rates up to 20,000 gpm, with negligible pressure drop.

Other plants use FLO-KLEAN for reclaiming used process water. Even when water isn't scarce, it still costs money, particularly if it has been heated for process work.

On this basis, Cuno FLO-KLEANS have paid for themselves in as short a time as six months.

They even reclaim their own backwash water—not wasting a drop!

Continuously Cleanable Permanent

The Cuno FLO-KLEAN positively removes all solids larger than specified. May be specified from .030 in. down to .0025 in. Operation is continuous—because the strainer is continuously self-cleaning. Therefore, full flow can be handled without needing a duplex installation.

With continuous backwash cleaning of the cartridge and automatic top and bottom blow-down, the FLO-KLEAN needs no attention.

All-metal construction is abrasive and corrosion-resistant.

Cuno Engineering Corporation
Dept. 141E, South Vine Street, Meriden, Conn.

Please send information on Cuno FLO-KLEAN for straining raw water....reclaiming process water....

Name.....Title.....

Company.....

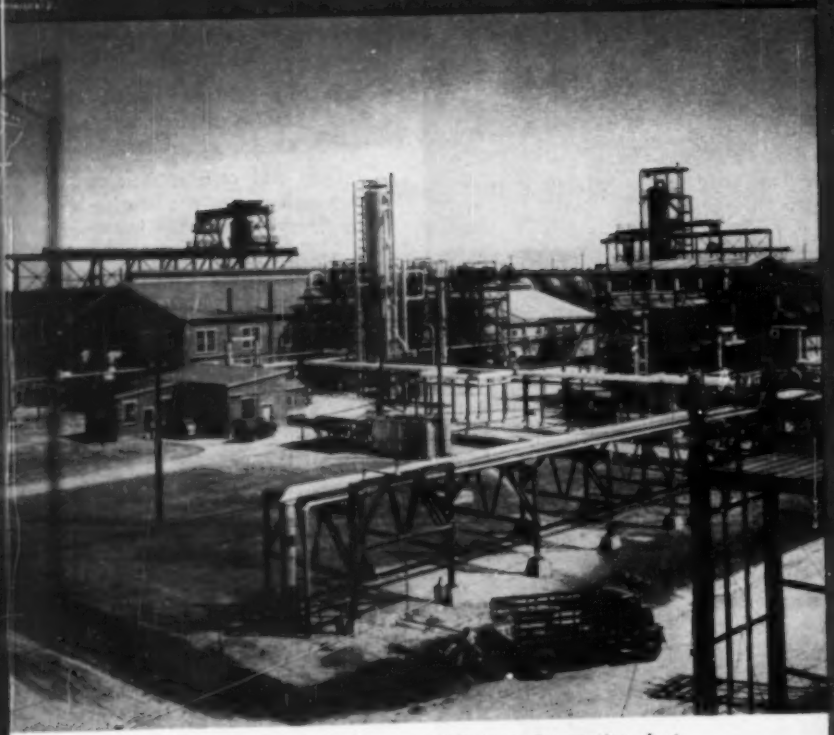
Address.....

City.....Zone....State....

Please attach to business letterhead

*

THE MODERN



Daily production at this Commercial Solvents Corporation plant has been more than quadrupled through modern instrumentation.

APPROACH TO *High Pressure* SYNTHESIS

BROWN INSTRUMENTATION

. . . is patterned to the exact requirements of individual plants and processes.

. . . is the result of engineering and application know-how, with one responsibility from sensing elements to control valves.

. . . is backed by a nation-wide field engineering and service organization.

IN VIEW of the shortage of synthetic methanol . . . vital as a solvent and for the preparation of formaldehyde . . . emphasis is on greater production through increased processing efficiency.

Tremendous strides toward this goal have been made at the Sterlington, La., plant of Commercial Solvents Corporation. With the help of extensive Brown Instrumentation, it has been possible to boost production of methanol to 45,000 gallons per day. All operations are monitored and controlled from a centrally located panelboard. Included are temperature and pressure recorders and controllers, safety devices and alarms, liquid level controllers and chemical analyzers . . . integrated into a complete system which synchronizes all phases of the process.

When looking for recording and controlling instruments for your high pressure synthesis, or *any chemical process—consider first:*

**The Brown know-how developed through many years of application experience in the industry.*

**The completeness of the Brown modern approach—recorders, controllers, panelboards (including Graphic Panels), valves and accessories.*

Call in our local engineering representative for a detailed discussion of your process control requirements . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4478 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
Brown Instruments

SERVICE HOURS

...*not Footage*

The True Yardstick of Air Hose Value

When buying air hose, your thinking should not be in terms of footage-per-dollar but rather in terms of service hours.

Experience tells you that the hose which is built with an *extra* measure of strength, flexibility, damage resistance and safety is surely your soundest investment.

This is true of *every* BWH Air Hose. Each has been specifically developed, tested and field-proven to give maximum long, trouble-free life in its job.

Get in touch with your BWH distributor — *today*.

BWH

DEPENDABLE RUGGEDNESS

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS.
P.O. BOX 1071, BOSTON 3, MASS., U. S. A.
Warehouse Stock, 111 N. Canal St., Chicago, Ill.

CONCORD AIR — An extra quality, exceptionally rugged hose for toughest use on air drill and pneumatic service in mines, quarries and construction jobs. Non-porous tube resists heat and oil. High tensile cotton yarn braid reinforced carcass. Tough grey cover resists cutting, gouging, abrasion. 7 sizes from ½" 2-braid through 2" 3-braid. 200 to 300 lbs. working pressure. Maximum length 50'.

BAY STATE AIR DRILL — For heavy construction work in mines, quarries, tunnels and wherever large size hose is required for long service. Smooth black tube resists heat and oil. Carcass of strong, rubber-impregnated multiple ply woven duck. Rugged, heavy-gauge red rubber cover resists severe weather extremes, cutting, abrasion. 9 sizes stocked from ½" to 4". Working pressures from 150 to 225 lbs. Max. length 50'.

AUROCHS AIR — For portable air compressors, jackhammers, rugged industrial and construction work. Smooth, black, non-porous tube resists heat and oil. Carcass: multiple ply, rubber-impregnated, rugged woven fabric. Tough black cover resists weather and abrasion. Stocked sizes: ½", ¾", 1". 200 lbs. working pressure. Maximum length 50'.

VIM AIR — For general industrial use, on compressors and pneumatic tools. Black tube resists oil and heat. Husky cotton yarn braids. Smooth, red cover resists weather, abrasion. 8 sizes stocked, ¼" 2-braid to 1" 3-braid. Working pressures: 150 to 225 lbs. Maximum length 500'.

BULL DOG VARI-PURPOSE AIR — For a variety of jobs including handling of air, water, oil, gasoline, kerosene (not for paints, lacquers, lacquer-solvents). Black, synthetic tube resists oil and heat. Carcass is braided rayon cord, high strength, super flexible. Smooth, brown, tough synthetic cover resists oil, abrasion, sunlight. 11 sizes stocked from 3/16" one-braid to 1" 2-braid. Working pressures: 200 to 300 lbs. Maximum length approximately 500'.

Instrument NEWS

ETHYL CORPORATION CUTS TEL TEST TIME WITH G-E X-RAY PHOTOMETER

General Electric's X-Ray Photometer has enabled Ethyl Corporation, Yonkers, N. Y. to cut time and expense in determining the tetraethyl lead (TEL) content of gasoline.

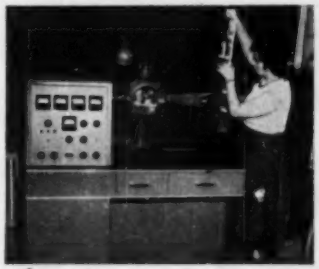
Previous standard methods of analysis require three hours to complete, including 20 minutes of operator time; whereas the G-E X-Ray Photometer requires only 15 minutes for the entire test.

The rapid analysis possible with the X-Ray Photometer has enabled closer control and has freed the chemist from routine work. Sturdy shielding and interlocks provide adequate protection for the operator. The General Electric X-Ray Photometer has maintained high accuracy of results, and the test is non-destructive in nature.

Operator inserts test cell in X-Ray Photometer at Ethyl Corporation, Yonkers, New York.

NAVAL RESEARCH LABORATORY STUDIES SURFACES WITH G-E ELECTRON DIFFRACTION INSTRUMENT

The U.S. Naval Research Laboratory, Washington, D.C., finds a wide variety of experimental applications for the G-E Electron Diffraction Instrument. In operation for approximately two years, the instrument enables the Laboratory to conduct studies and experiments on all types of surfaces.



Electron Diffraction Instrument installed at U. S. Naval Research Laboratory, Washington, D. C. Operator shown loading camera in preparation for sample study. (Official United States Navy Photograph.)

With the General Electric Electron Diffraction Instrument, surface studies of corrosion, and organic film adsorption are made, leading to the development of new materials by the Lubrication Branch of the Chemistry Division. This is one of the units used at the Naval Research Laboratory at this time (left).

A leading feature of the instrument is its large specimen chamber. This makes it unnecessary to cut up specimens. Testing is non-destructive and valuable samples are preserved. The unit enables the study of systems at various stages of the experiments.

Great versatility is achieved by variable beam voltage, which can be adjusted to a maximum of 50,000 volts. The Naval Research Laboratory finds it advantageous to operate at 35,000 volts, for their work.

ESSO INSTALLS A G-E MASS SPECTROMETER

At the Esso Research Center, Linden, N. J., the G-E mass spectrometer has proven valuable in the solution of difficult analytical problems arising in connection with petroleum processes, products and derivatives. Advantage is taken of its high resolving power in the analysis of a wide variety of materials. Direct recording is a very useful feature.

NEW 1952 CATALOG

NOW AVAILABLE

"MEASURING EQUIPMENT for laboratory and production testing"

CLIP THE COUPON BELOW

General Electric Co., Section G 587-81
Schenectady, N. Y.

(√) Indicate for reference only
(X) For planning an immediate project

Please send me the following bulletins:

- ☐ GEC-412A—X-Ray Photometer
- ☐ GEC-587—Mass Spectrometer
- ☐ GEC-588—Dewpoint Recorder
- ☐ GEC-656—Electron Diffraction Inst.
- ☐ GEC-1016—New 1952 Catalog

Name .....

Address .....

Company .....

City ..... State .....

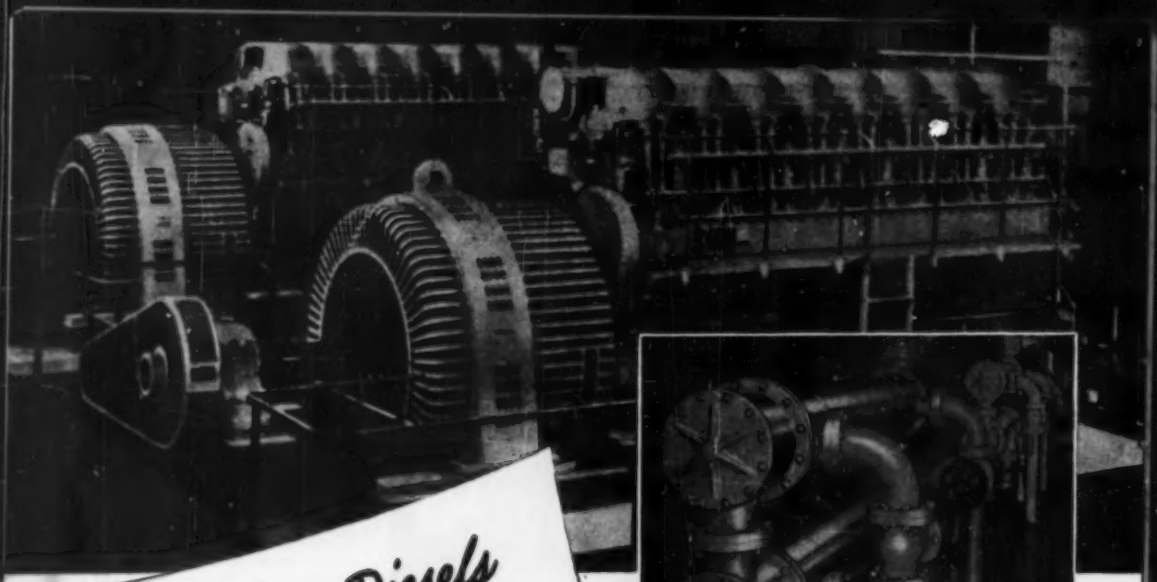
DEWPOINT RECORDER CHECKS MOISTURE FOR CHRYSLER AIRTEMP

Better moisture control of air used for drying refrigerator coils, has been achieved with a G-E Dewpoint Recorder, installed at Chrysler Airtemp Division, Chrysler Corporation, Dayton, Ohio.

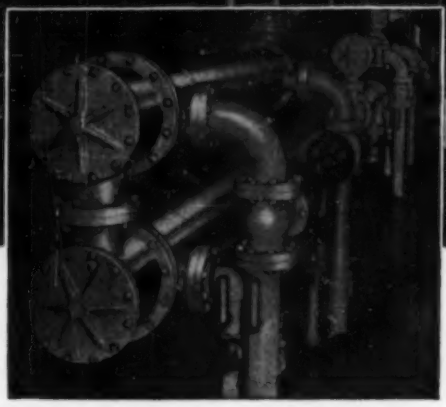
Large dehydrating equipment supplies dry air for this operation. With the Dewpoint Recorder, a continuous check and permanent record is kept of the moisture content of the air before it enters the coils, resulting in savings in material and labor.

The G-E device replaced a test which was slow and used large amounts of CO_2.

GENERAL ELECTRIC



Baldwin Diesels Use Ross Exchangers



for simplified piping, facility in controlling engine lube oil and jacket water temperature

Mecca of vacationists from all over the world, in the center of the Adirondacks often referred to as America's Switzerland, Saranac Lake, is also distinguished in power circles for its commendable diesel electric installation.

For here, two Baldwin diesel electric generating sets consisting of two Baldwin Model 600 Diesels, 1450 bhp at 600 rpm each, direct-connected to generators with capacities of 1250 kva, 1000 kw and 2300 volts have solved, at a moderate cost, a growing power shortage during the peak-load, dry season.

Among the many distinguished features of this ideal installation is the compact, simplified, easily controlled engine cooling system which utilizes four Ross Type CP Exchangers, one for maintaining most effective operating temperature of the lubricating oil and one for the jacket water of each engine. Because the Ross Type CP is a pre-engineered exchanger, made up from fully standardized, mass-produced components and subassemblies, considerable engineering time was saved, while individualized fabrication was eliminated . . . *advantages that are attractive not only to Baldwin-Lima-Hamilton Corporation, but to most builders of diesels and compressors.*

But, the big point is not the fact that this installation is at Saranac Lake, N. Y. It could well be a diesel application of a larger or smaller rating for an oil field, pipeline, mine, locomotive, sawmill, factory or chemical plant. No matter which, no matter what the make, you'll generally find on the equipment list: "Exchangers by Ross". *Diesel builders have too much at stake — they must KNOW the exchanger can be depended upon!*

To obtain full details on the Ross CP, write for Bulletin 2.1K1 and consult with your nearby Ross representative.

ROSS

EXCHANGERS

ROSS HEATER & MFG. CO., INC.

Division of American Radiator & Standard Sanitary Corporation

1411 West Avenue **Buffalo 13, N. Y.**

In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

Serving home and industry

AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

The right spot for a PAYLOADER

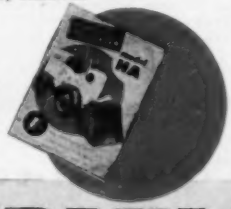
What is the right spot for a PAYLOADER? It's any place inside your buildings or in the yard where bulk materials are being handled by laborious or other obsolete methods. Thousands of these special tractor-shovels are in "right spots" *today* cutting costs, solving manpower shortages and increasing output.

PAYLOADERS are able to pay for themselves in a few months because they are designed for the specific job of handling bulk materials of all kinds — loading, unloading, scooping, lifting, carrying, dumping and spreading. Outstanding reasons for the performance and acceptance of PAYLOADERS include: short, compact, space-saving design; multiple reverse speeds; large pneumatic tires that permit operation indoors and outdoors . . . on paved or unpaved areas; simple, easy operation; complete hydraulic bucket control.

The 12 cu. ft. model HA shown is an outstanding box car unloader. It is the smallest of six PAYLOADER sizes which range up to 1½ cu. yd. bucket capacity. Every PAYLOADER is backed by 30 years of manufacturing experience and by a world-wide Distributor service organization. The Frank G. Hough Co., 754 Sunnyside Avenue, Libertyville, Illinois.

- Unload box cars.
- Dig and carry fertilizer, chemicals, other bulk materials.
- Clean up gangways, aisles and other areas.
- Load and unload trucks.
- Load box cars.
- Feed conveyors, elevators, hoppers, mixers.
- Charge mullers, tumbling barrels.
- Lift-haul-push-pull.
- Stockpile coal, coke.
- Remove snow.

Write for literature on PAYLOADERS and the name of your Hough Distributor. He'll be glad to help you find the "right spot" for the right size of PAYLOADER in your operations. No obligation.



PAYLOADER®

THE FRANK G. HOUGH CO. • *Since 1920*

how to "liquidate" alien ions....

VERSENE ELIMINATES METALLIC CONTAMINATION

Foreign metallic ions are all enemies of industrial processing and products. They promote decomposition, rancidity, odor, coloration and cause many other undesirable reactions. Versene destroys these troublemakers by neutralizing them efficiently and economically. It does so by reacting with most metallic ions to form soluble non-ionic chelate compounds of such great strength that the alien ions are completely "liquidated", and can no longer interfere with the quality of your products and processes.

VERSENE OFFERS EXCEPTIONAL STABILITY

Completely stable in solution, Versene does not decompose in either acid or alkaline solution, or at high temperatures. It is stable and inert against attack from any chemical compound except strong oxidizing agents such as permanganate and acid dichromate. Available in dry or liquid form, the Versenes are the tetra sodium salts of Ethylene Diamine Tetra Acetic Acid and other polyamino acids. They are the most versatile and the most powerful complexing (chelating) agents known.

VERSENES—FOR QUALITY CONTROL

When your processes and products are upset by those troublemakers — *foreign metallic ions* — at least one of the seven Versenes can probably help you "liquidate" them. Call on the Versenes for *quality control.* Write Dept. B. Send for Technical Bulletin No. 2. Ask for samples.

"industry's most modern chemicals"

NEW VERSENE WATER TEST KIT. Tells total hardness in 2 minutes. Accurate to one grain per gallon. Versenate Method. Complete Kit $5. postpaid.

* Trade Mark

BERSWORTH CHEMICAL COMPANY

FRAMINGHAM, MASSACHUSETTS

Warehouse Stocks

Providence Agent: George Mann, 231 Fox Point Boulevard, Providence, Rhode Island
W. Coast Agent: Griffin Chemical Co., San Francisco, Los Angeles
Midwest Agent: Kraft Chemical Co., Inc., 917 W. 18th St., Chicago
Wasatch Chemical Co., Salt Lake City, Utah
Berardo & Page, Inc., Dallas and Houston, Texas
Associated Chemical Co. of Canada, 14 Darrell Ave., Toronto, Ontario
Chas. S. Tanner Co., 1815 Liberty Life Bldg., Charlotte, North Carolina

This 'dust' man is worth his weight in gold–to you

He can help you to new profit possibilities in the recovery of valuable escaping dust

There are still many industrial men who have yet to sit across the desk from an industrial dust engineer–a man who may be actually worth his weight in gold to you.

If you are one of these men, you have a revealing half-hour in store–a half-hour that can mean new profits…improved product and/or process…top over-all efficiency.

The reason? Buell's staff of industrial 'dust' men draw on more than 200 man-years of experience in the design and construction of high-efficiency, trouble-free Dust Recovery Systems. You will learn of the success of hundreds of Buell Installations. You will learn how one can be designed for you.

'SF' Electric Precipitator for collecting acid mist.

C. O. ROSENBERG, A. B. P. S.

For full information about Buell Dust Recovery and Dust Collection Systems, write today. Ask for the new illustrated Buell 'Dust Recovery' bulletin. It can be a highly profitable move. Buell Engineering Company Dept. 12-L, 70 Pine Street, New York 5, N. Y.

ELECTRIC CYCLONIC · buell

HIGH EFFICIENCY CYCLONES • ELECTRIC PRECIPITATORS
TYPE 'LN' COLLECTORS • LOW DRAFT LOSS COLLECTORS
SPECIAL PURPOSE COLLECTORS • DUST HOPPER VALVES

ENGINEERED EFFICIENCY IN DUST RECOVERY

How Mississippi Chemical

They did

Mississippi Chemical had a series of *over-all* electrical problems when they were planning this plant.

what

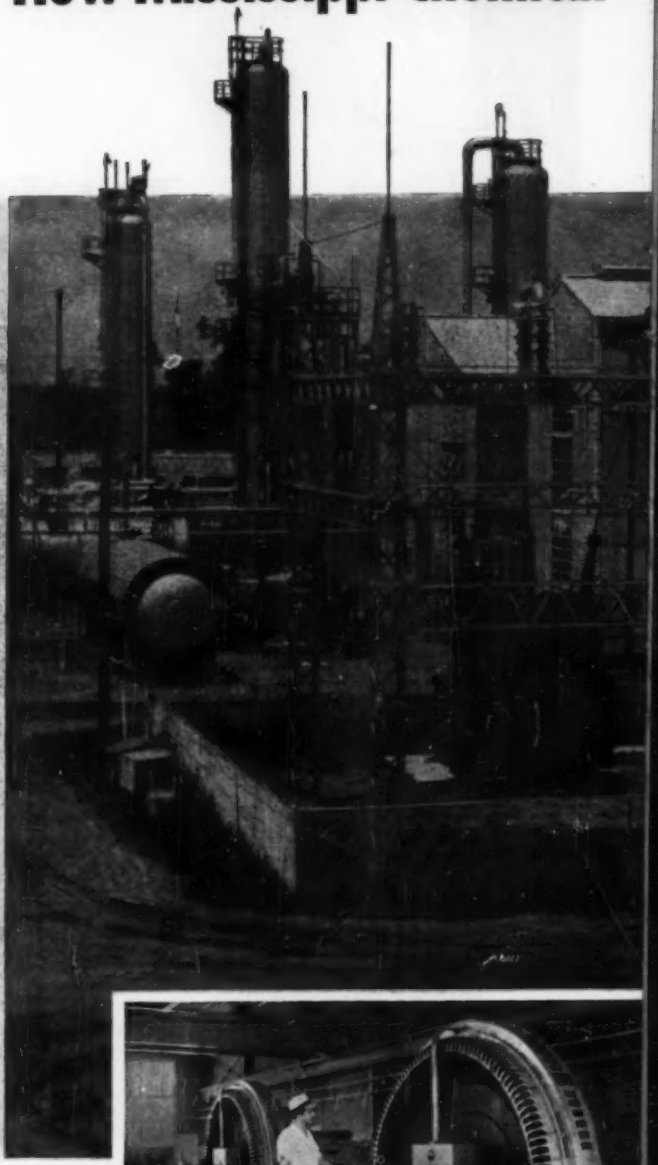
They had Girdler and Westinghouse Engineers *attack these problems as a whole.* Based on previous experience they put together a *co-ordinated electrical system.*

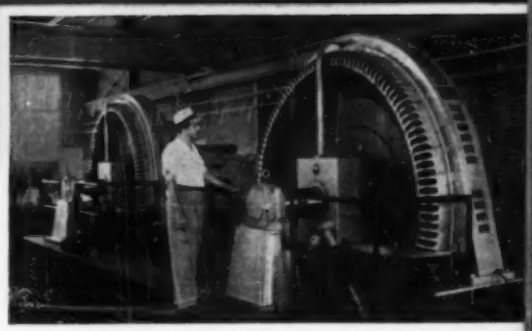
you can do

This experience and this over-all method can be applied to your next project, whatever it is. Westinghouse can work with you on *all* your electrical needs.

to produce more

The result will be more dependable production . . . lower costs . . . better operations. Whether you need one motor, or a complex electrical system, call in Westinghouse.





Ammonia Superintendent inspects the 900-hp hyper compressor in the ammonia compressor room. Driving this compressor and all the other drives in the plant are Westinghouse Motors. These motors have a lower installed cost . . . are easier to operate . . . and require less maintenance than other types of drives.

got the BEST power equipment . . .

at no EXTRA cost!

Mississippi Chemical Company recently built a new plant in Yazoo City, Mississippi. For the electrical engineering, Westinghouse and the Girdler Corp., the engineers and prime contractors, put their heads together. By careful planning they developed a power system that uses the best type of modern equipment *but at no extra cost.* They made savings that offset the higher price. Here's how they did it.

Dependable, Low-Cost Power. To make use of the low-cost power available from the Mississippi Power and Light Company, a complete Westinghouse Substation was installed. Included were two 6000/7500-kva transformers. This rating permits line-starting of the large compressor motors and eliminates the need for costly special controls. The best secondary voltage was determined to be 2400/4160Y-volts. This reduces the size of the copper wire . . . keeps line losses at a minimum . . . and can be easily handled by standard transformers.

Top Motor Performance and Protection. For the main compressor drive, they chose electric motors because they have a lower installed cost . . . are easier to operate . . . and require less maintenance than other drives. The motor control centers were installed throughout the plant in non-hazardous locations. They got the advantage of grouped control without using more expensive, explosion-proof equipment.

Emergency Power Assured. For insurance purposes, an immediate source of stand-by power was required. Neither a combustion engine nor a condensing turbine met the requirements of fast, easy operation. However, a Westinghouse Type E turbine did the trick. It could be started by one man . . . reach full operation in 20 seconds . . . and it costs 25 percent less than any other adequate unit.

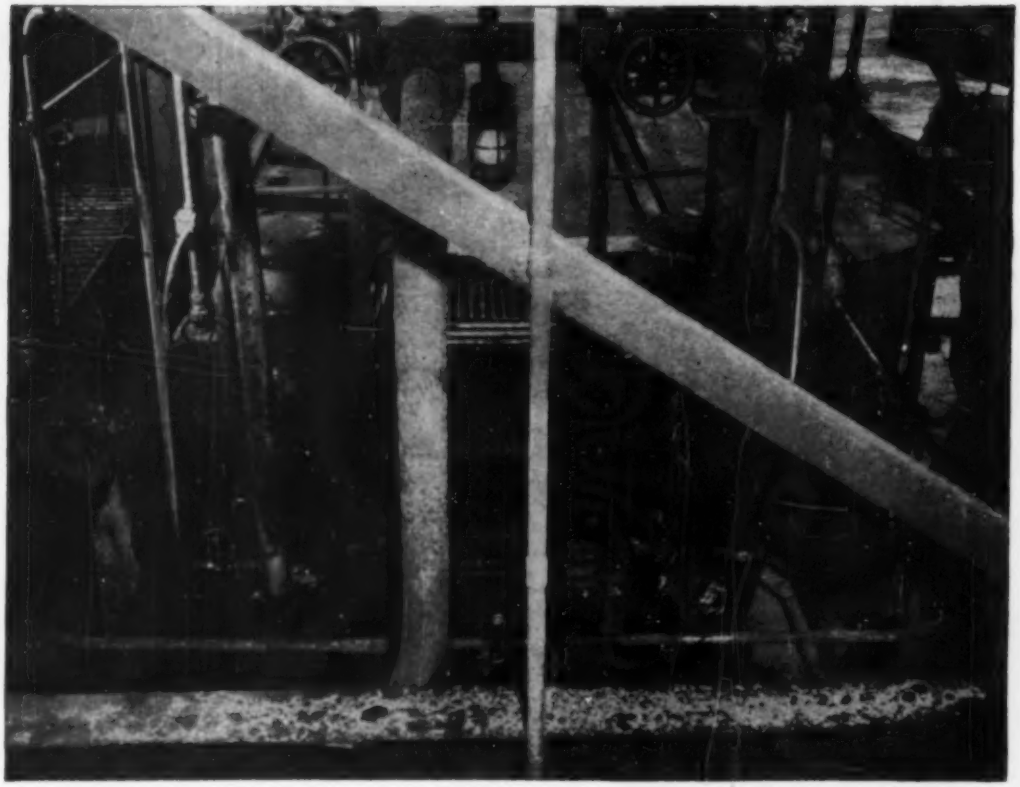
Westinghouse Can Help You. The next time you plan to build or expand your plant, call in Westinghouse. You can get these same benefits . . . the results of accurate system planning and dependable Westinghouse equipment. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94902

Shown here is a Westinghouse Power and Control Center which supplies the power for the motors in the ammonia plant. These power and control centers are installed throughout the plant in nonhazardous locations to take advantage of grouped control.

you can be SURE ... if it's

Westinghouse

ELECTRICAL EQUIPMENT
FOR THE CHEMICAL INDUSTRY



Another Case of "MORE OF THE SAME"

The LaBour Type G pumps in this picture have been in service a little more than three years, handling ammonium sulphate saturated mother liquors. Some time ago we shipped additional pumps of this type to the same user, and as this is written, more of the same are on order.

When a company has had years of experience with a piece of equipment, and continues to buy more and more equipment from the same maker, there can be only one answer. Most of the business LaBour enjoys today comes from customers who have had previous experience with LaBour pumps, some dating back 25 years and longer.

If you're looking for the kind of dependable pump service that makes you want more of the same, you'll get it from LaBour.

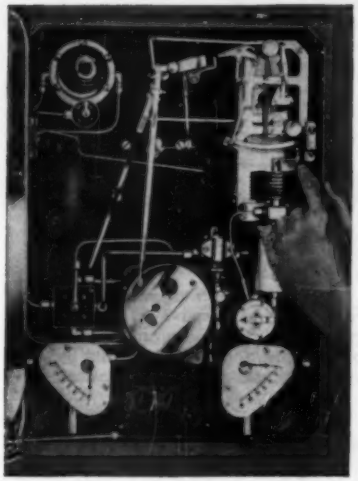
ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.

Anybody Can Take Care of a BRISTOL SERIES 500 CONTROLLER

Plant operating men quickly become familiar with it... and like to use it



Only One Simple Adjustment

Write or call your local Bristol representative. And write for Bulletin A120. THE BRISTOL COMPANY, 109 Bristol Road, Waterbury 20, Conn.

BRISTOL

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Gunthard BUILDS HOMOGENEOUS LEAD-LINED EQUIPMENT.....

This 8' x 30' homogeneous lead-lined pressure vessel has recently been installed in one of the world's largest petroleum refineries.

Gunthard equipment and know-how was specified here to eliminate breakdowns and thus reduce costly shutdown time to a minimum.

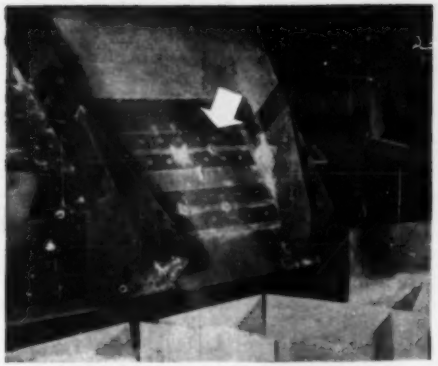
The results show
SAVINGS IN MAN HOURS
SAVINGS IN OVERALL OPERATING COSTS
in excess of the original cost of the vessel.

The Gunthard organization has every facility for fabricating homogeneous lead-lined equipment—from 2 inch carbon steel fittings and all sizes of tanks and vessels, up to massive 90 foot towers. Skinned personnel fabricate equipment of every type from ferrous and non-ferrous metals including aluminum, stainless, stainless-clad and carbon steels.

We number among our regular customers many of the largest and most progressive chemical processing companies in the nation. If you have a problem that might be solved by expert metal fabrication—with or without lead lining or covering—write for complete information on how Gunthard engineering services and facilities can be of provable cost-cutting value to you.

A. GUNTHARD COMPANY ENNIS, TEXAS

Here are places where the Dings PERMA-PLATE MAGNET can save you money!



SPAGHETTI MAKER SAVES $80.00 PER WEEK with two Dings 4-pole Perma-Plate Magnets to catch tramp iron formerly removed by hand. Magnets also remove iron of abrasion that formerly was not removed.

KEEPING IRON OUT OF CANDY BARS with a Perma-Plate installed in chute to remove fine iron from chocolate in liquid form.

RECORD MAKER PROTECTS DIES AND MOLDS. View shows flow of material over Alnico magnet — note bits of wire.

PREVENTING IRON DAMAGE TO GARNETT ROLLS in a bedding plant with a Dings Perma-Plate Magnet installed above the spiked apron feeder.

IF you would do away with all types of stray iron — nails, nuts, bolts, wire, etc., and its effects, whether it be product contamination . . . damage to machinery . . . or fires and explosions caused by stray iron sparks — CALL FOR THE DINGS PERMA-PLATE. A look at its report card tells why:

NON-ELECTRIC PERMANENT. No power costs, no electrical maintenance or accessories.

POWERFUL, POSITIVE. There are 50 years of magnet design experience behind the Perma-Plate.

MAGNETIC PERMANENCE GUARANTEED. Your assurance of magnetic protection *always*.

HANDLES SOLIDS OR LIQUIDS, HOT OR COLD. Easily installed anywhere, the Perma-Plate is available in 228 different size and strength combinations to provide you with *exactly* the right magnet for the job.

Send for CATALOG C-1205-A

Complete Details on the Perma-Plate Including Sizes and Prices. ASK FOR THE PERMA-PLATE CATALOG.

Certified MAGNETIC STRENGTH

YOU WON'T SAY "DANG IT" IF YOU "DING" IT

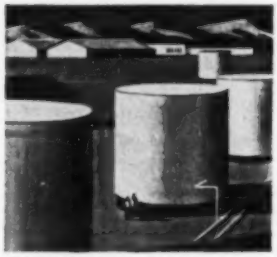
DINGS MAGNETIC SEPARATOR CO.

4730 W. Electric Ave., Milwaukee 46, Wis.

World's Largest Exclusive Builders of Electric and Non-Electric Magnetic Separators for All Industry

RE-USABLE ALUMINUM DRUMS are stronger than standard steel drums . . . will stand up longer under rough treatment.

ALUMINUM DRUMS, compared to steel, have high resistance to corrosion . . . have no lining to break or peel. Unlike carboys, no glass to shatter.



STORAGE TANKS and railroad cars are among other applications made of aluminum that have high resistance to corrosion, minimum tendency to contaminate—longer life!

Which one has the Toni?

To prevent contamination, chemicals that go into the famous Toni Home Permanent must be shipped in either glass carboys or aluminum drums.

And here's why the *aluminum* drum—manufactured by Benson from Kaiser Aluminum—always gets the Toni:

Eight times as much material can be shipped in aluminum drums for the same tare weight. A *freight saving* of as much as $8.00 per round trip is made when using an aluminum drum instead of a glass carboy. And *all* handling costs are greatly reduced, because aluminum drums are lighter, easier to handle.

Glass carboys can—and often do—break. But breakage is eliminated when aluminum drums are used.

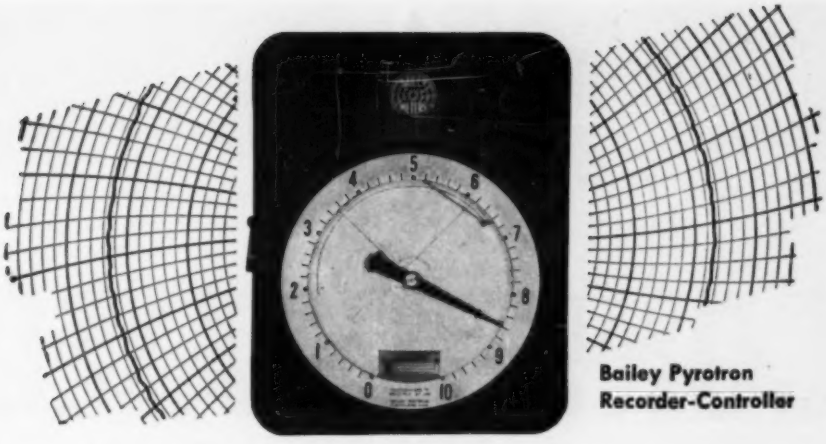
And aluminum drums, unlike glass carboys, do not have to be shipped in wooden crates that require the expense of constant repairs and eventual replacement.

For full information on how aluminum can help you ship or store chemicals, call us today! You'll find Kaiser Aluminum listed in yellow section of the phone book.

Kaiser Aluminum

Setting the pace . . . through quality and service

KAISER ALUMINUM & CHEMICAL SALES, INC., Oakland, California—offices in principal cities—is sales agent for Benson chemical drums.



Bailey Pyrotron
Recorder-Controller

Looking for Better Temperature Instruments?

...Then check these features of Pyrotron Electronic Resistance Thermometers...

FUNDAMENTAL ACCURACY

Bailey Pyrotron Resistance Elements are made of highest purity platinum—the material used by the National Bureau of Standards in establishing basic standards for temperatures from −190°C to +660°C.

THREE TYPES OF CONTROL

Pyrotron Controllers may operate: on-off electrical systems by either electronic relays or electric contacts, modulated electronic systems, or air-operated systems. Two temperatures may be recorded on the same chart and controlled by a single instrument.

FACTS PUT INTO USABLE FORM

Bailey Pyrotrons may be arranged to put temperature facts into convenient usable forms. If two or more temperatures are related, they may be recorded as continuous records on the same chart for easy comparison. The average of several temperatures or the difference between two temperatures may be recorded as a single continuous record which may be retransmitted to a distant point or used to actuate a control system.

EASY INSTALLATION

Bailey Pyrotrons do not require careful leveling or protection against vibration. Three ordinary copper wires are all that is needed to connect each temperature sensitive element with the recorder. Power may be taken from any 115 volt 60 cycle circuit.

MINIMUM MAINTENANCE

The absence of galvanometers, batteries and standardizing equipment, together with the use of interchangeable unit assemblies, reduces Pyrotron maintenance to the vanishing point.

ABUNDANT POWER

A separate motor drive for each temperature furnishes abundant power to operate a recording pen, a controller and an alarm switch.

For the full story on this unusual electronic resistance thermometer which is suitable for ranges between −300°F and 1200°F, ask for Bulletin No. 230-C. F-21

BAILEY METER COMPANY

1054 IVANHOE ROAD • • • CLEVELAND 10, OHIO

TEMPERATURE FLOW
PRESSURE LEVEL
% OXYGEN DENSITY
% COMBUSTION RATIO

Controlled processing

CONSOLIDATED

Announces

another important step to help make sulphur go further

Consolidated Chemical Industries Inc. has announced the construction of a plant at Baton Rouge, Louisiana, especially designed to use spent sulphuric acid as a raw material in producing high strength new acid. When this plant is completed—late in 1952—production capacity will be substantially increased without requiring additional sulphur.

This step is the latest in a long line taken by Consolidated in a continuing effort to better serve users of sulphuric acid.

The first step—taken some years ago—was to handle spent acid of various grades. This relieved some users of their disposal problems and it made low cost acid available to other users.

When the supply of sulphur became critical, handling of spent acid was greatly intensified. Furthermore, certain existing facilities were devoted to producing new acid from the lower grades of spent acid.

Now Consolidated is building a large plant especially to process spent acid. This will mean a further improvement in the service available to Consolidated customers.

3150 A

CONSOLIDATED CHEMICAL INDUSTRIES INC.

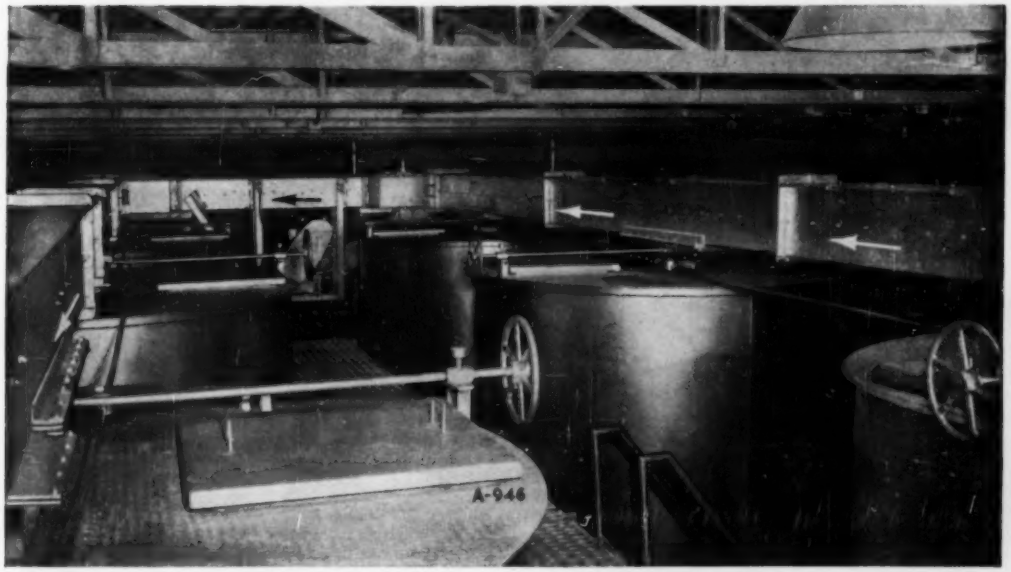
SALES OFFICES: SAN FRANCISCO • HOUSTON • NEW YORK

More Than Conveyor Service—
This is SELECTIVE DISTRIBUTION

At this modern plant, a completely mechanized S-A bulk handling system moves chemicals from rail cars to storage at lowest cost per ton.

One part of the handling system designed, built and installed by S-A engineers consists of a closed-circuit REDLER conveyor. The closed-circuit design, a unique REDLER feature, permits *selective distribution* to any outlet point and re-circulation of surplus material in the conveyor. REDLER compactness permitted installation in very restricted space.

Low cost per ton handled is the true measure of a successful conveyor installation. S-A engineers, with 50 years of experience and a *complete* line of bulk handling equipment, are ready to help you reach the goal of efficiency at the lowest possible cost. Consult with S-A on your next bulk handling problem . . . there is no obligation.



REDLER CLOSED-CIRCUIT CHEMICAL CONVEYORS

Efficient system of conveyors and elevators unloads and moves lime, alum and other bulk chemicals to storage. Because system is totally enclosed and dust-tight, it protects materials from contamination and prevents loss by spillage. One unit in the system, a closed-circuit REDLER conveyor, makes a complete circuit over a battery of six storage tanks discharging the various chemicals into the right tanks. Material in the conveyor can be re-circulated until needed at any selected discharge outlet.

1901-1951

50 years experience with bulk handling

STEPHEN S-A ADAMSON MFG. CO.

3 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

What's the cheapest refrigerant?

Water.

And it's good, too. Especially the way we use it in the new Carrier Absorption Refrigerating Machine.

We take our refrigerant in from the load and spray it into the cooler. Because our absorbent keeps the pressure low, some of the water flashes and cools the remaining water. Then the water is pumped off to the load.

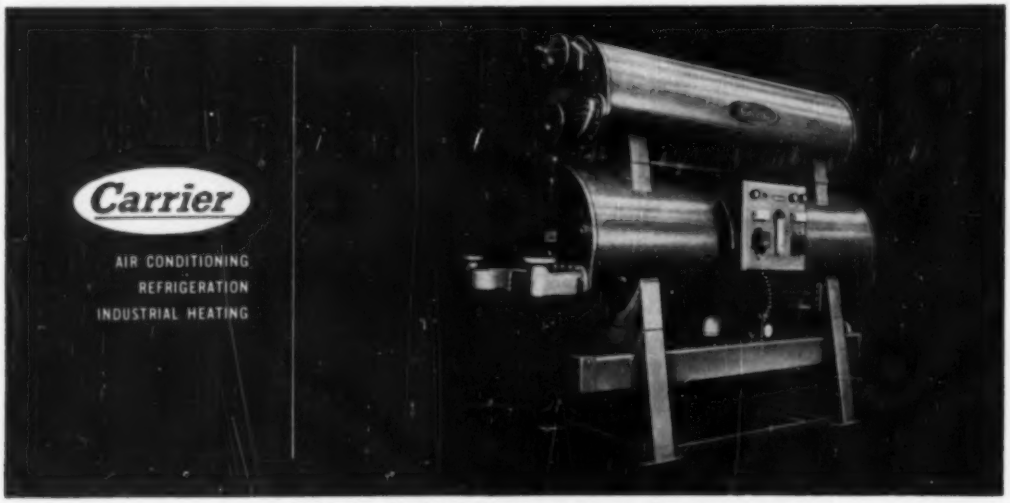
As the absorbent picks up the water vapor and becomes diluted it is pumped to the generator where steam boils off the water vapor. This vapor is then condensed and returned to the chilled water circuit.

Do you get the picture? This is a simple machine. It has no moving parts . . . except for one small pump.

So with no moving parts you'll have little maintenance . . . and there won't be any vibration . . . so you won't need heavy (and expensive) foundations.

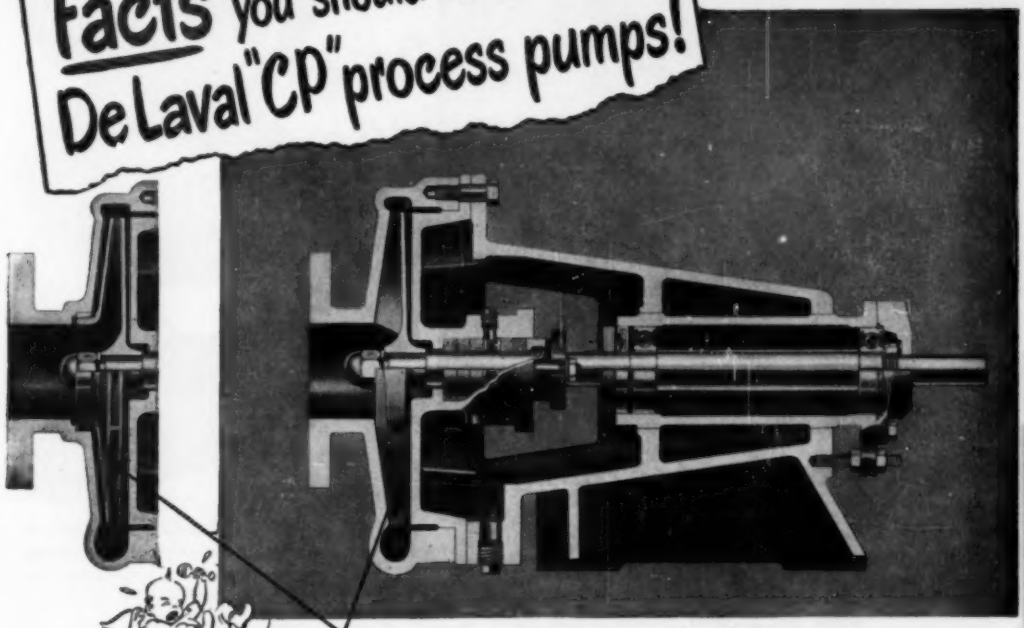
And it's powered by high or low pressure steam . . . which isn't expensive . . . especially in the summer. You get a ton of refrigeration, by the way, for 20 pounds of steam per hour. And the machine adjusts itself to loads down to 10% of capacity.

Beyond this, with a salt absorbent (which won't poison anybody, won't burn or explode) and water as a refrigerant, the machine is absolutely safe. A booklet tells the whole story. It's yours for the asking. Carrier Corporation, Syracuse 1, N. Y.



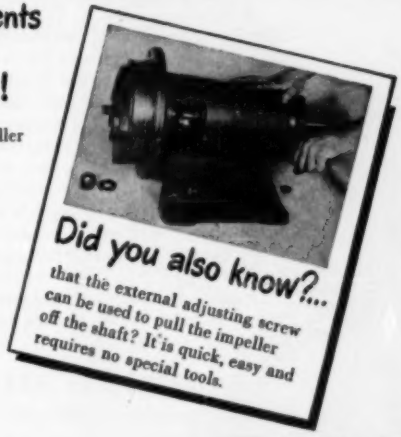
The Carrier Absorption Refrigerating Machine is available in 115, 150, 200, 270 and 350 ton capacities. It is readily adaptable to multi-unit installations.

Facts you should know about De Laval "CP" process pumps!



When service requirements change, you don't have to buy a whole new pump!

The De Laval CP pump can be quickly converted from closed to open impeller (or vice versa) by changing the pump volute and impeller only. This standardization also means you can keep your stock of spare parts to a minimum. Three sizes of shafts, shaft lock-nuts, bearings, bearing cartridges and pedestals *fit all nine sizes of De Laval CP pumps.*



Did you also know?...

that the external adjusting screw can be used to pull the impeller off the shaft? It is quick, easy and requires no special tools.

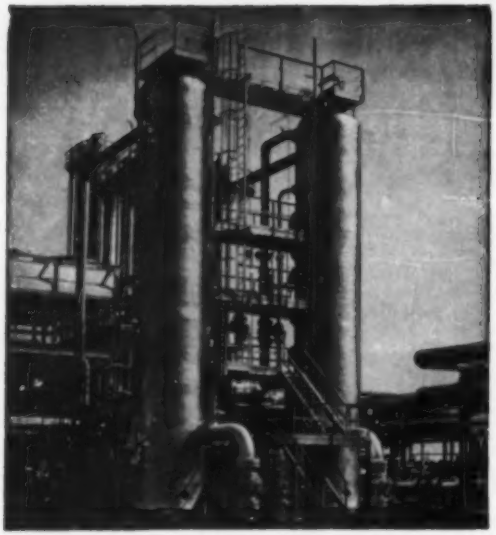
Shims and fussy fits are old fashioned...

When you have to compensate for wear between the impeller and case, it is only necessary to face off these parts, reassemble the pump and position the impeller with the external adjusting screw provided for that purpose. No shims required—no fussy fits.

DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

50th DE LAVAL Anniversary



Panoma has found

FLORITE

"very satisfactory"

The Panoma Plant of the Panoma Corporation, near Hooker, Okla., uses Florite in its dehydration towers, which were handling daily at last report, 85 million standard cubic feet of natural gas at a pressure of 675 pounds. They were designed to handle 140 million standard cubic feet at 750 pounds pressure. Gas dehydration is required in preparation for pipeline transmission.

This large modern plant has been in use since November, 1948, and, according to a report of the Panoma management at the end of a year, "has operated very satisfactorily."

Floridin Products, adapted to a wide range of industrial and technical uses, include especially prepared forms of

FULLERS EARTH

as well as two grades of Florite, which is a . . . .

BAUXITE-BASED ADSORBENT

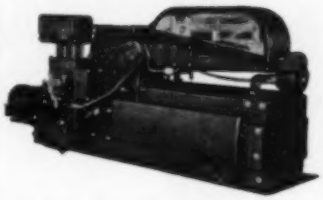
Your inquiry will be given careful attention.

FLORIDIN COMPANY

Adsorbents . . . Desiccants . . . Diluents

W&T MERCHEN WEIGH FEEDERS

Give Greater Product Uniformity



Weigh-blending of chemical ingredients — the only *accurate* way to blend—calls for precision equipment and "know-how".

W&T Merchen Weigh Feeders meet the first of these requirements with these features:

- Feed and weigh in *one* operation
- Handle ounces to hundreds of pounds per minute
- Manual or automatic control
- Easy accessibility
- Handy feed register
- Meet underwriters class II group G specifications

Your W&T Representative brings you the "know-how" from his experience in supervising and servicing hundreds of Merchen Weigh Feeder installations.

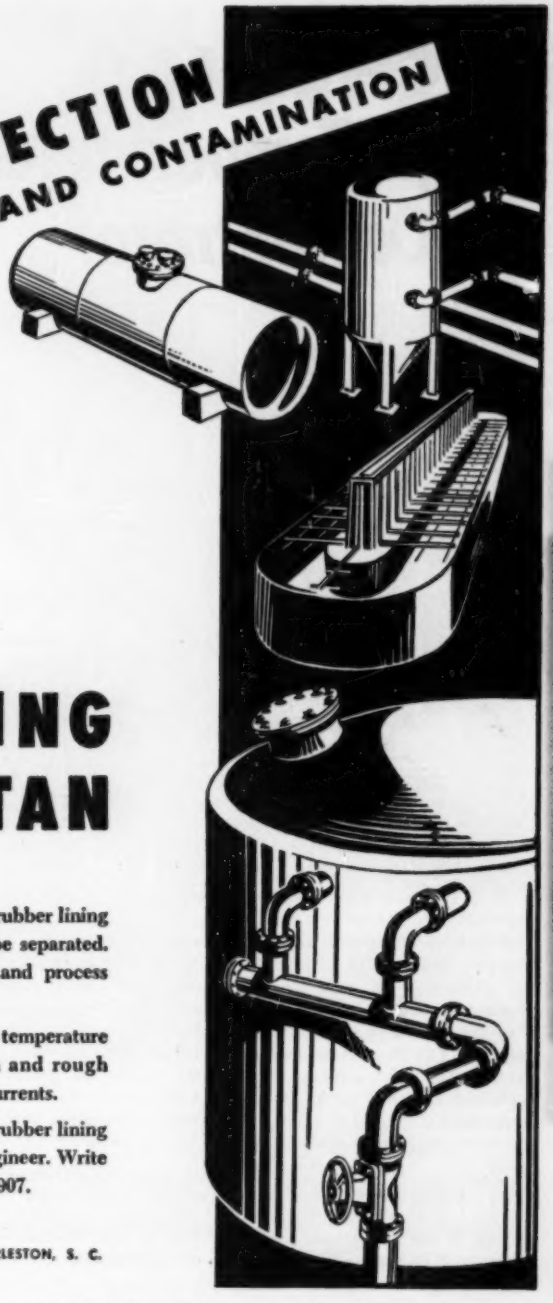
Write today for Descriptive Bulletins.

M-15a

WALLACE & TIERNAN

COMPANY, INC.

BONDED PROTECTION
AGAINST CORROSION AND CONTAMINATION



RUBBER LINING BY MANHATTAN

"Bonded to Stay . . ."

That's Manhattan's claim to fame. Every Manhattan rubber lining is so securely bonded to metal—it can't physically be separated. This means permanent protection for equipment and process against loss by corrosion and contamination.

They expand and contract with the metal under temperature changes without cracking. They resist abrasion and rough handling and in plating equipment eliminate stray currents.

Before you invest be sure to investigate . . . the R/M rubber lining facilities near you. Consult an R/M rubber lining engineer. Write for Tank Bulletin MR557 and Pipe Lining Bulletin 6907.

RUBBER LINING PLANTS AT PASSAIC, N. J. AND NORTH CHARLESTON, S. C.

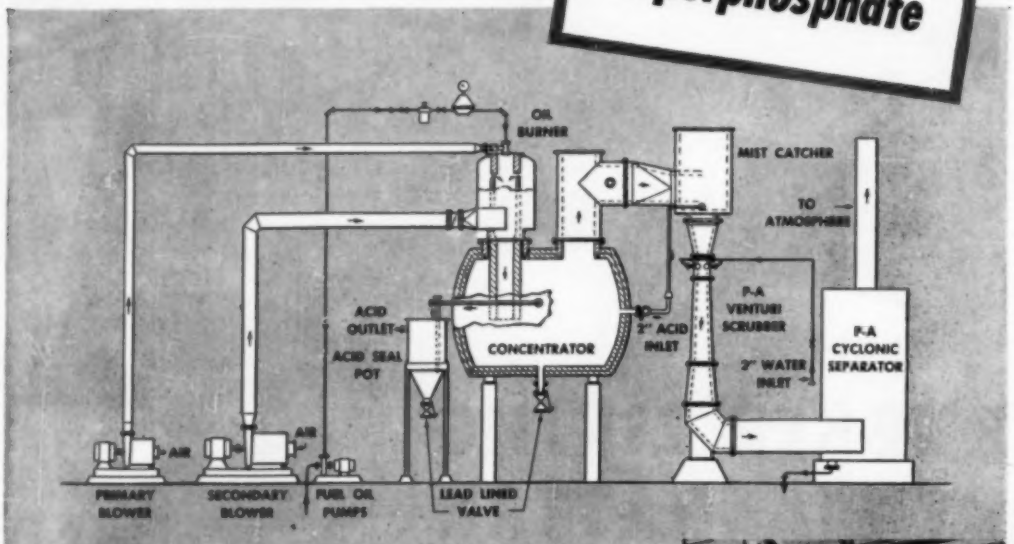
MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

CHEMICO
High Temperature Concentrator

FOR EFFICIENT PRODUCTION OF *Triple Superphosphate*

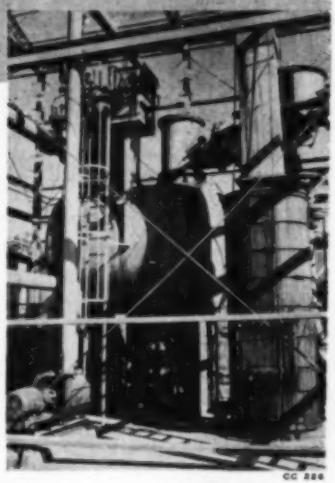


This new Chemico High Temperature Concentrator at the Gates Bros., Inc., Wendell, Idaho plant has a daily output of 60 tons of 50 per cent phosphoric acid per day, calculated as P_2O_5.

The Chemico phosphoric acid concentrator is especially adapted for the production of high strength phosphoric acid and triple superphosphate. It offers two major advantages. (1) It uses combustion gas at 2500F which accounts for its high heat efficiency (90+%). (2) It produces a very small volume of gas to be scrubbed at the concentrator exit.

Here's how it works: Hot combustion gas is released under the surface of the acid where it gives up most of its heat and emerges at a temperature slightly above that of the acid itself. The combustion of the fuel takes place in a dip pipe, specially designed to withstand high temperature on the inside and the corrosive action of the acid on the outside. Exit gases pass through a Pease-Anthony Venturi Scrubber which eliminates acid mist with 99+% efficiency.

If you are thinking of producing triple superphosphate or phosphoric acid by the wet process, it will pay you to ask Chemico for specific recommendations.



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CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

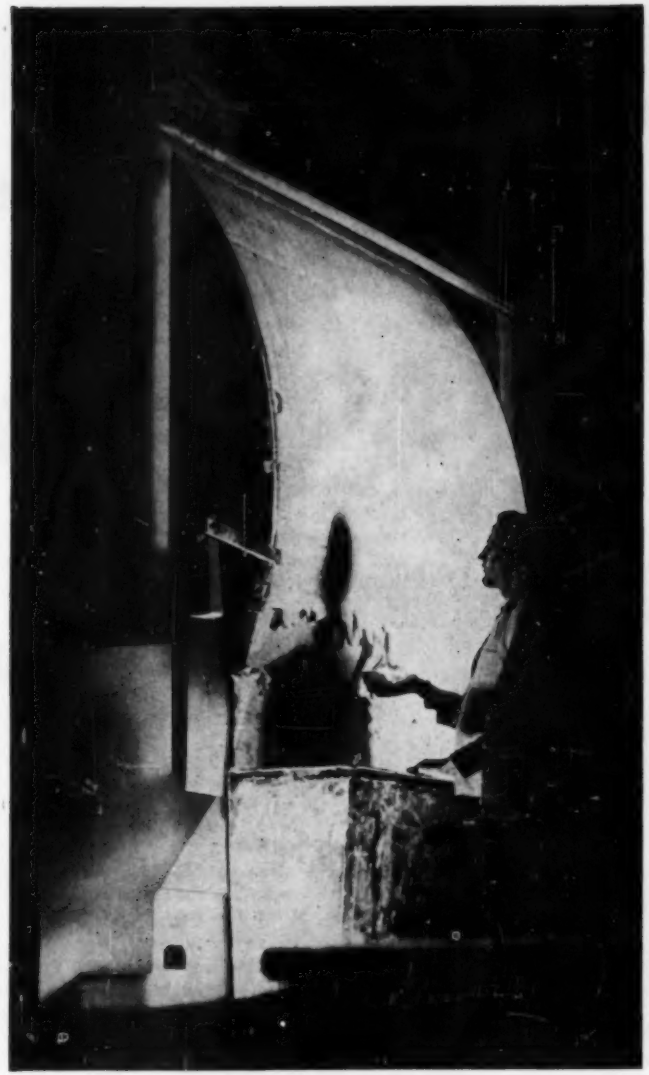
488 MADISON AVENUE, NEW YORK 22, N. Y.

CABLES: CHEMICONST, NEW YORK

EUROPEAN TECHNICAL REPRESENTATIVE

CYANAMID PRODUCTS, LTD., NORTH WEST WING, BUSH HOUSE, ALDWYCH, LONDON W.C. 2, ENGLAND

Chemico Plants Are Profitable Investments



OLIVER *Chemical* FILTER

"TOPS" in Continuous Vacuum Filtration!

The Plant . . .
Wyandotte Chemicals Corporation, Wyandotte, Michigan.

The Product . . .
Wyandotte 'PURECAL', a pure, thoroughly washed precipitated calcium carbonate; the filtrate is sodium chloride.

The Record . . .
"These filters (there are several in the plant) have been in use about six years in a continuous twenty-four hour operation and have given very satisfactory service."

Oliver United engineers have many filter types, both continuous vacuum and pressure, with which to meet your filtration needs. This wide variety in filters is backed up by an experience in filtration and clarification that goes back to 1907 when the first Oliver Filter was placed on the market . . . by an experience that has covered every division of the process industries.

New York 18 — 33 W. 42nd St. Chicago 1 — 221 N. LaSalle St.
Oakland 1 — 2900 Glascock St. San Francisco 11 — 260 Calif. St.
Export Sales Office — New York • Cable — OLIUNIFILT

FACTORIES:
Hazleton, Pa.
Oakland, Calif.

OLIVER UNITED FILTERS INC.

WORLD WIDE SALES, SERVICE AND MANUFACTURING FACILITIES

CANADA
E. Long, Ltd.
Orillia, Ontario

MEXICO & CENT. AMERICA
Oliver United Filters Inc.
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INDIA
Dorr-Oliver (India) Ltd., Bombay

EUROPE & NORTH AFRICA
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Dorr-Oliver S.N.a.R.L. Paris
Dorr g.m.b.h. Wiesbaden (16)
Dorr-Oliver Co., Ltd., London, S.W. 1
Dorr-Oliver S.a.R.L. Milano
Dorr-Oliver, N.V. Amsterdam-C

PHILIPPINE ISLANDS
E. J. Nell Co.
Manila

HAWAIIAN ISLANDS
Honolulu
A. R. Duvall

WEST INDIES
Wm. A. Powe — Havana

SOUTH AMERICA & ASIA
The Dorr Co.
Stamford, Conn.

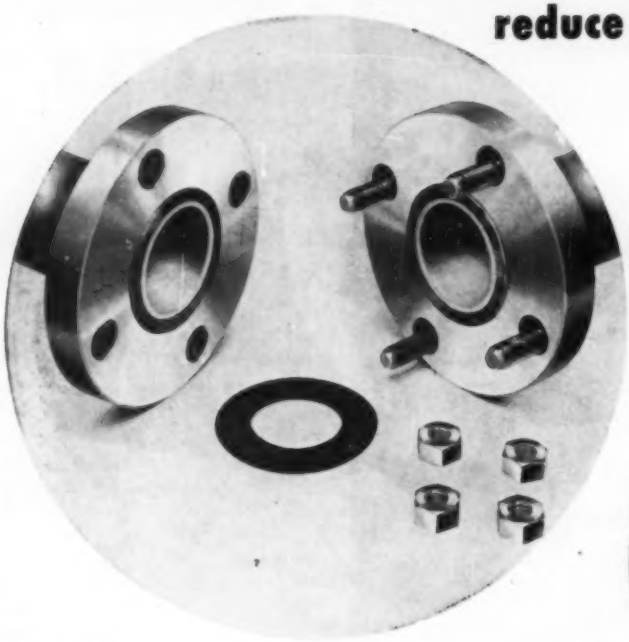
AUSTRALIA
Hobart Duff Pty., Ltd.
Melbourne

SOUTH AFRICA
E. L. Bateman Pty., Ltd.
Johannesburg, Transvaal

New corrosion-resistant fittings

reduce assembly time

reduce piping costs, too!



Speedline aligning connector

Joins pipe schedules 5, 10 and 40. Also made for use with tubing.

Speedline insert flange

Corrosion-resistant serrated insert in a carbon steel flange. Only tools needed for assembly are a standard expander and open-end wrench.

Speedline tube union

Combines best features of screwed pipe and sanitary unions; eliminates leakage encountered with ground joint type fittings.

• Fast, low-cost installation of light-wall, corrosion-resistant lines is now possible with *Speedline* Fittings. Exclusive design of flange, for example, eliminates need for welding or flaring. Joints are tight and leakproof . . . a big improvement over other types of fittings.

The cost of *Speedline* Fittings is surprisingly low. And because you can use light weight Schedule 5 pipe or tubing, your piping costs are reduced by as much as 40%. As one engineer says: "We started to use *Speedline* Fittings with Schedule 5 pipe to save money. Now we find that we also get better flow conditions and increased capacity in our lines."

To learn more about this way to improve process piping layouts—at a lower cost than you have been paying, ask for a copy of the *Speedline* Fittings book.

Book Shows How to Save Money —Even Under Today's Conditions

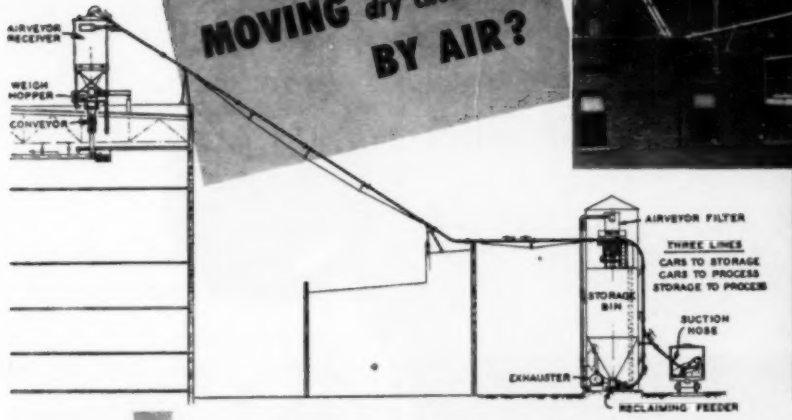
Just write a note on your company letterhead and we will mail the *Speedline* book to you. It shows *why* you get better results at less cost with *Speedline* Fittings.

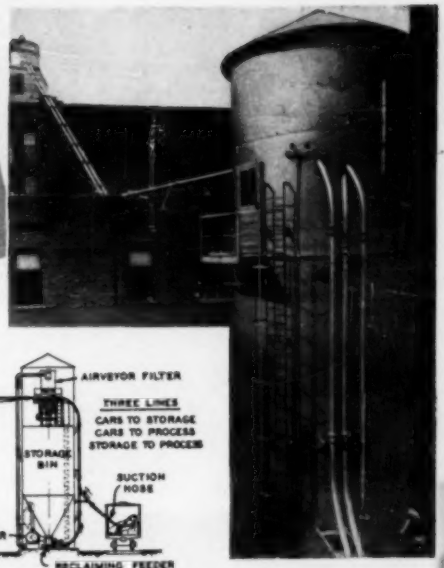
Speedline Corrosion-Resistant FITTINGS

—the newest thing in pipeline economy

HORACE T. POTTS CO. *Since 1815* Erie Avenue & D Street • Philadelphia 34, Pa.

have you ever considered
MOVING dry chemicals
BY AIR?





it's cheaper—safer—more efficient

"The **AIRVEYOR**"

Moving air has great carrying ability. When it's controlled, air supports and transports dry granular or pulverized materials at high speed to any predetermined point.

For example—a leading soap manufacturer, using the Airveyor, has found the savings quickly pay for this better method of handling light soda ash. Unloading, conveying to, and reclaiming from storage for delivery to process in the plant, is accomplished quickly and with a minimum of labor. The Airveyor requires the attention of only one man. Important from the safety angle is the fact that dusting has been eliminated. Few moving parts assure reduced maintenance.

Note the compact, simple layout of the system illustrated . . . the storage bin located alongside of the railroad track, with the Airveyor filter directly above, and the exhauster below the bin, all within the same structure.

The Airveyor in this plant unloads from cars to storage and reclaims from storage for delivery to process. The system is so arranged that material can also be conveyed direct from cars to process if desired. Longest conveying distance—200 feet.

Why not investigate the possibilities of this flexible system of handling chemicals in your plant? Airveyors handle a wide range of dry pulverized and granular ingredients—safely, cleanly, economically, speedily and efficiently. Without obligation, a Fuller engineer will analyze your present conveying system and show you how the Airveyor can help in your operations.

Fuller

DRY MATERIAL CONVEYING SYSTEMS
AND COOLERS—COMPRESSORS
AND VACUUM PUMPS—FEEDERS,
AND ASSOCIATED EQUIPMENT

FULLER COMPANY
Catasauqua, Pennsylvania
Chicago 3—120 So. LaSalle St.
San Francisco 4—420 Chancery Bldg.

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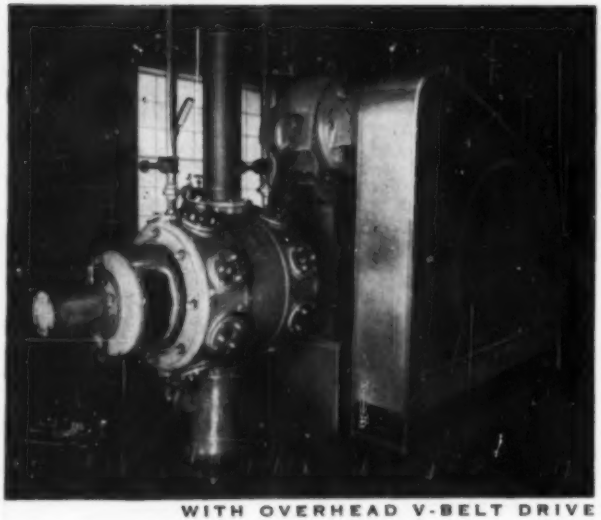
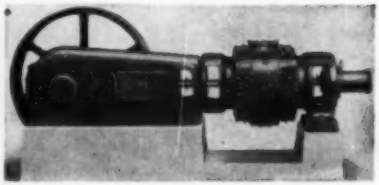
AIR FREE FROM OIL



WITH OVERHEAD V-BELT DRIVE



CLASS T-BO BELT-DRIVEN
OIL-LESS CYLINDER COMPRESSOR

Since no oil, grease or other cylinder lubricant is required in CP OIL-LESS CYLINDER COMPRESSORS, they are ideal where it is essential that compressed air be absolutely free from oil to avoid injury to products.

Piston and rod, completely supported by tail rod and outboard crosshead, are full floating, removing all weight from cylinder wall and stuffing boxes. This assures long life of segmented carbon piston rings, with no need for periodically rotating them.

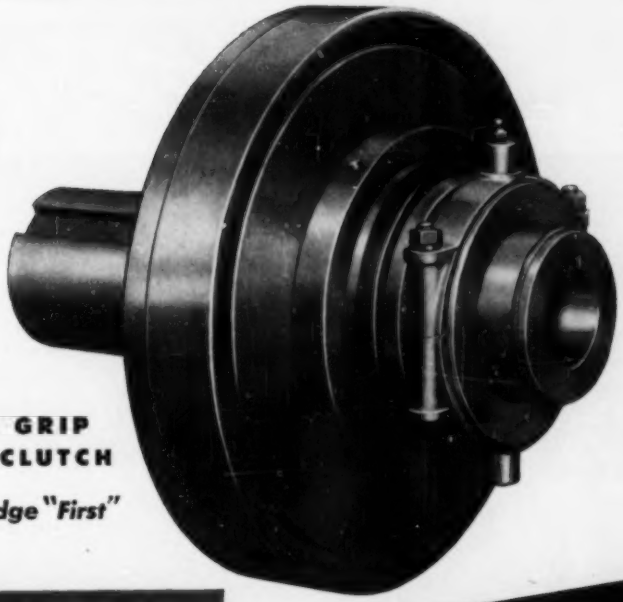
CP OIL-LESS CYLINDER COMPRESSORS are available in a wide range of sizes and ratings; in single and two-stage types; arranged for belt, motor or steam drive.

WRITE FOR BULLETIN 728-8

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



ROLLING GRIP FRICTION CLUTCH

—another Dodge "First"

It's Compact—

It's Flexible—

It's Smooth—

NO TOGGLES!

New and simplified design results in new ease of control, together with positive drive and extreme ruggedness. Dodge Rolling Grip Friction Clutches provide trouble-free, dependable service on many thousands of industry's tough installations.

There are no toggles! Instead, the mechanism shifts smoothly on hardened steel balls—and has the positive grip of a wedge. Operating parts are completely enclosed for safety, yet quickly accessible for service.

Dodge Rolling Grip Friction Clutches are available from distributors' stocks in two types—Bolted Plate and Gear Tooth Mechanism—in sizes from ⅓ H.P. to 21 H.P. at 100 R.P.M. For complete data, including easy Selection Tables, call your Dodge Distributor or write us. For capacities ranging from 21 H.P. to 470 H.P., ask for data on the famous Dodge Diamond D Friction Clutches.

Call the Transmissioneer, your local Dodge Distributor. He's factory-trained to help solve your power-drive problems. He has information on latest transmission developments. Look for his name under "Power Transmission Machinery" in your classified telephone directory.

DODGE MANUFACTURING CORPORATION, 288 **Union Street, Mishawaka, Indiana**

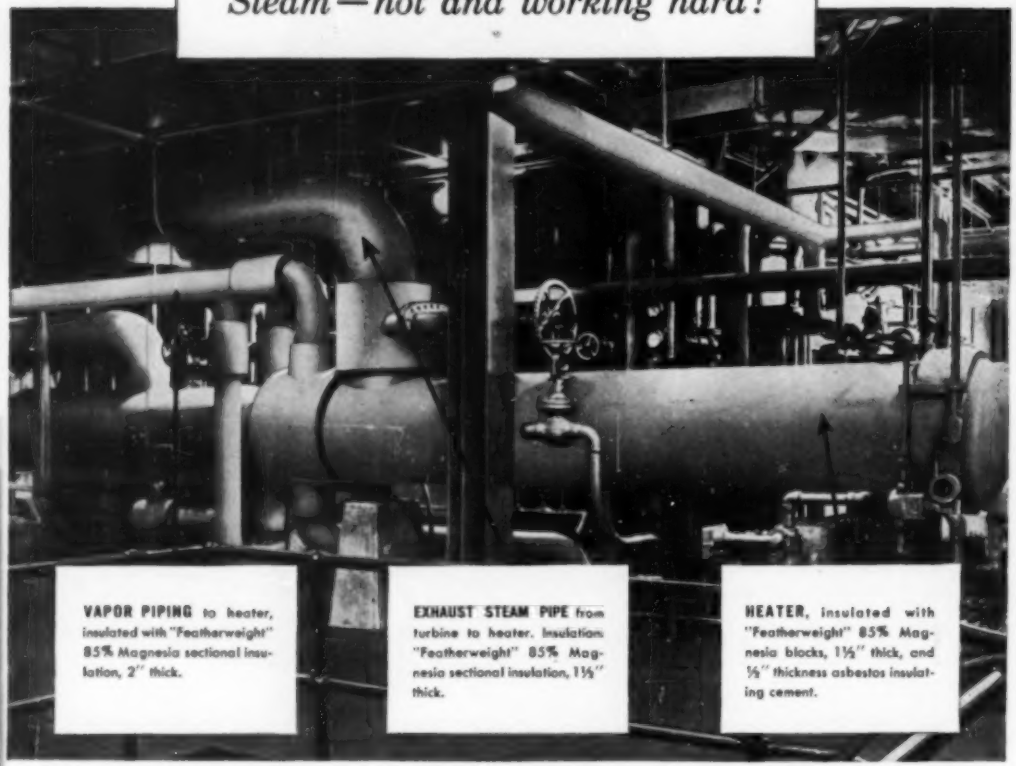
DODGE

of Mishawaka, Ind.

FIRST IN POWER TRANSMISSION MACHINERY

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

Steam—hot and working hard!



VAPOR PIPING to heater, insulated with "Featherweight" 85% Magnesia sectional insulation, 2" thick.

EXHAUST STEAM PIPE from turbine to heater. Insulation "Featherweight" 85% Magnesia sectional insulation, 1½" thick.

HEATER, insulated with "Featherweight" 85% Magnesia blocks, 1½" thick, and ⅛" thickness asbestos insulating cement.

These Keasbey & Mattison Insulations keep heat on the job—keep heating costs down!

Steam is expensive to produce . . . and far too valuable to waste. That's why "Featherweight"® 85% Magnesia was the insulation used in this large Southwestern utility plant.

"Featherweight" 85% Magnesia gives maximum protection against heat loss—keeps steam "on the job" wherever and whenever it's wanted!

This is but one of thousands of installations of "Featherweight" 85% Magnesia Insulation—on ships, in power plants, in the chemical process and food industries. With a background of more than 60 years' service, "Featherweight" is today one of the most widely used and favorably accepted insulations for temperatures up to 600° F. When used in combination with K&M Hy-Temp Insulation, "Featherweight" 85% Magnesia is efficient and practical for temperatures up to 1900° F.

Ask your distributor, who is also an experienced applicator, for complete information on "Featherweight" 85% Magnesia, or any insulations in the complete K&M line. Or, write us.

The newest development in thermal insulation: "KaytherM" High Temperature Blocks

A product of years of research and development! "KaytherM" provides maximum efficiency up to 1500° F. It is molded to size . . . incombustible . . . insoluble in water . . . has exceptional strength and high dimensional stability . . . is light in weight . . . easy to handle . . . quickly applied. Available in flat blocks 6" x 36"; in thicknesses of 1", 1½", and 2".

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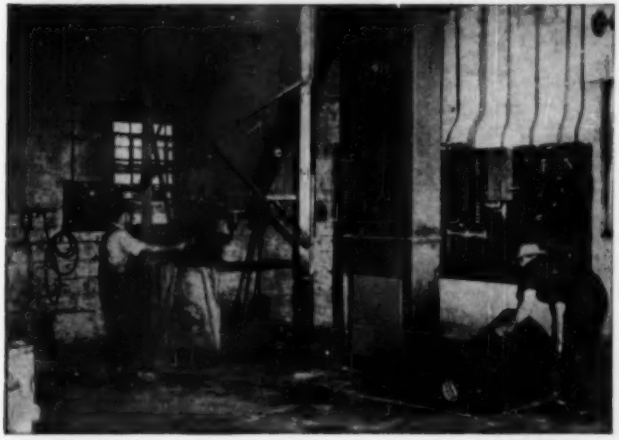
pointers to BETTER PROCESSING

EQUIPMENT INFORMATION FOR PROCESSING PLANTS



GLUE MANUFACTURER

Gets Product Uniformity ...Saves Man Hours and Floor Space—with

Sprout-Waldron Vertical Batch Blender

PROBLEM:

A prominent hide glue manufacturer found it necessary to reduce mixing and packing costs. Since Sprout-Waldron was experienced in this phase of glue processing...had previously furnished equipment for similar operations—it was a natural assignment for S-W Engineers.

The source of the trouble was soon traced to mixing operations...just before packaging. Here, obsolete methods and equipment were running production costs way out of line. Excessive man hours and valuable floor space were considered necessary evils. Almost three hours were consumed in mixing a 10,000 lb. batch. And, an operator had to "stand by" under dusty conditions during the process.

SOLUTION:

A 300 cu. ft. S-W vertical, self-cleaning batch blender equipped with weighing unit now does the job, in conjunction with one bucket elevator. This combination *saves space, is dust-tight, and fast.*

RESULTS:

1. Perfect batch uniformity
2. Mixing time reduced from 3 hours to 15 minutes
3. 125 sq. ft. of floor space saved
4. Mixing and packing costs cut in half

If you have a *mixing or blending problem,* why not take it up with Sprout, Waldron & Co., Inc., 15 Waldron St., Muncy, Pa.

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Bulk Materials Handling

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Mixing & Blending

Processing Equipment

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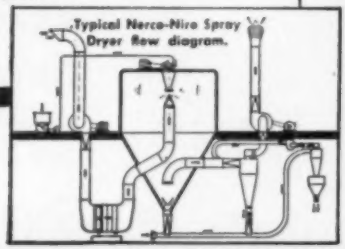
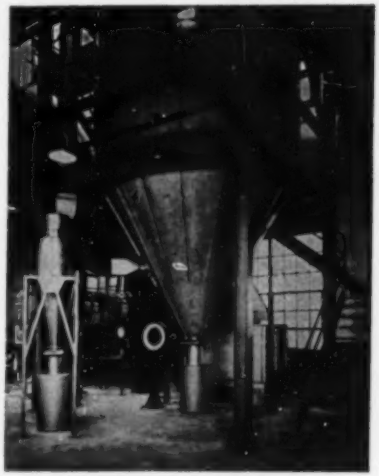
For most spray drying applications in the chemical industries NERCO-NIRO is the answer.

Backed by more than 20 years of extensive research.
Easy to clean—easy to operate.
Low production and maintenance cost.
Reliable performance and non-clogging atomizer.
Complete recovery of solids without the use of filters or wet scrubbers.
Laboratory facilities available for test purposes.

Recent installation in U.S.A. shown at extreme right.





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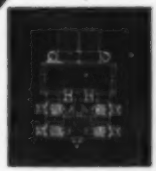

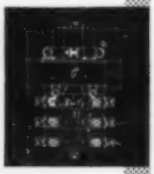

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Simplex, duplex or dual operation

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for chemical apportioning

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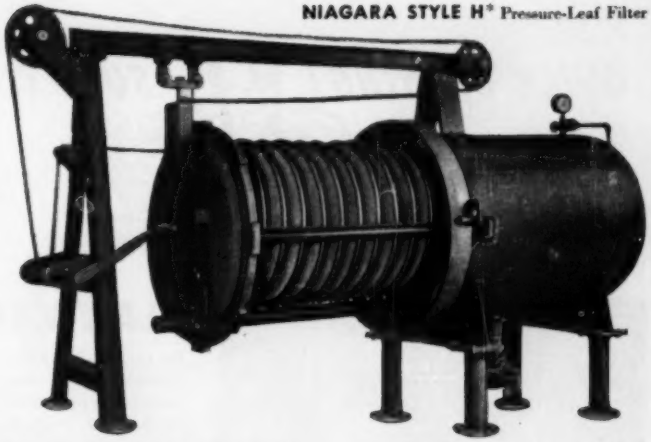
New *Niagara Filter* Gives



MORE PRODUCTION WITH LESS LABOR

on filtrations involving high % of solids

Here at last is a clarifying filter with *high solids capacity* (up to 150 cu. ft. per unit) that gives you production rates *2 to 3 times as fast* as conventional presses—plus quickest, easiest cake discharge ever known! One man, operating several Niagaras, can easily produce as much as *three* men on conventional presses!

CUTS CLEANING TIME TO MINUTES! Gives you far more *productive filter time* per day! One operator easily discharges up to 150 cu. ft. of filter cake, in minutes instead of hours. Cakes are discharged in semi-dry state, ready for disposal or recovery.

ENDS COSTLY CLOTH REPLACEMENT AND WASHING! Press cloths are completely eliminated with Niagara all-metal leaves, proved in use in Niagara vertical filters. You save every penny you now spend on cloth replacement—plus every minute now used to wash and handle press cloths!

Check these advantages—Flow rates to 1000 GPM per unit . . . Solids capacity to 150 cu. ft. per unit . . . All-welded, leakproof construction—safe for handling volatile, flammable, explosive materials . . . Easily steam-jacketed . . . Excellent cake washing characteristics . . . Sharpest filtrate clarity . . . Interchangeable leaves.

FOR MORE FACTS—mail the coupon or write us today!

LEAVES ROLL OUT as a single unit, for quick easy cleaning. Monorail and windlass assembly are a permanent integral part of the filter. Windlass is hand operated, can be motorized on large filters.

CAKE DROPS OFF when leaves are tapped with rubber mallet. Air-blown cakes separate readily from the stainless steel leaves.

COVER LOCKS and unlocks with one fast, easy motion. A girl can operate the Niagara Q/O* cover. No handwheels, eyebolts, spokes or spiders.

*Trade Mark Pat. Applied for.

Niagara Filter CORPORATION

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NIAGARA FILTER CORP., 3007 Main St., Buffalo 14, N.Y.
Please send me Bulletin H-1051 on the Style H Filter.

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for curing chambers, vulcanizers, and similar equipment, are *quick—tight—boltless.* In diameters up to 10 ft., they may be used on pressures up to 250 psi. They are rim-locking; manually or mechanically operated.

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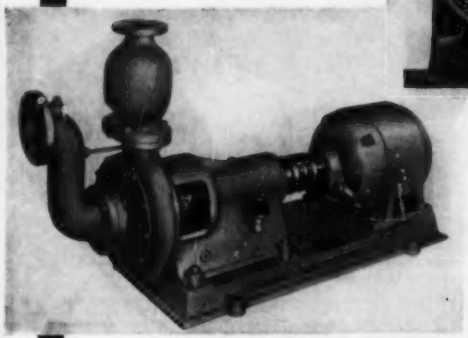
(*Right*) Lawrence Self-Priming Pump exhausting air during priming.



(*Left*) Lawrence Heavy Duty Self-Priming Chemical Pump.

LAWRENCE...
SELF-PRIMING PUMPS

Patent Applied For

A new type for many exacting services

The Lawrence self-priming pump introduces a new feature: — specifically, a pump that operates as a positive air pump during priming and then as a regular centrifugal pump. No valves of any kind are required. After priming, it operates — without recirculation of the liquid — at full efficiency.

Because dead spaces are eliminated and clearances are not close, the pump can be used for pumping liquids containing solids and abrasive matter in suspension. It can be furnished in all sizes for all classes of service: — water, slurry, sludge, acids and chemicals.

For further information and performance data, write for Bulletin 210-1.

LAWRENCE PUMPS

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MACHINE & PUMP CORPORATION
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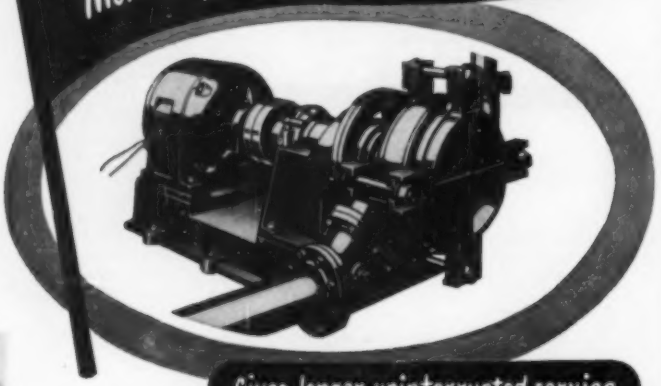
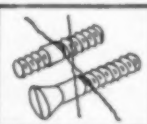
Helps avoid your biggest pump problems
Morris Type "R" Slurry Pump



Gives longer uninterrupted service

Ordinarily harsh abrasives wear out your pump. The corrosive action of acids eats away its utility. Time-consuming maintenance and repairs cut down your production. Now see why the Morris Type "R" helps avoid these problems.

1		**Simple design**—The Morris Type "R" has no internal studs and bolts. Nor does it have troublesome internal joints and fits. The Suction Disc Liner is merely clamped into position between disc and shell. *Fewer wearing parts means less maintenance and longer uninterrupted service.*
2		**Easily dismantled**—The impeller and shaft sleeve of the Morris Type "R" Slurry Pump can be renewed without disturbing the suction and discharge piping or the bearings. This means considerably less lay-up time.
3		**More abrasive resistant**—With the clamping effect of the bolts on the discs, the shell is not subject to high stress. Consequently, the shell can be made of a large variety of materials, including those of high abrasive resistance. Yet these materials need not necessarily be of high tensile strength.
4		**The hydraulic passages of the suction disc are extremely large and velocities are low. As a result, wear is minimized and renewal infrequent.**
5		**Stuffing box troubles are practically eliminated because the suction gland is under low suction pressure only.**

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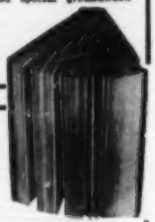

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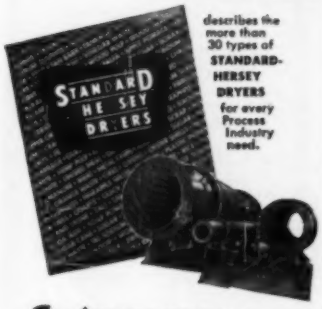

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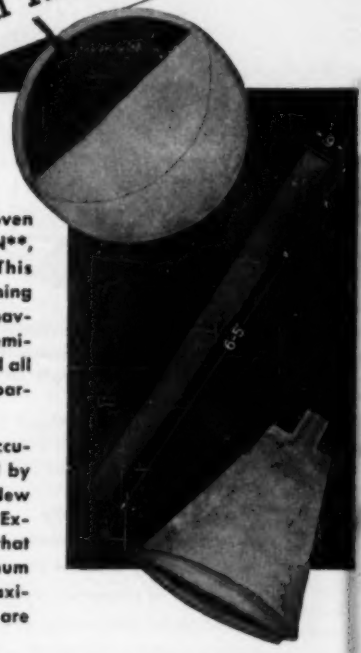

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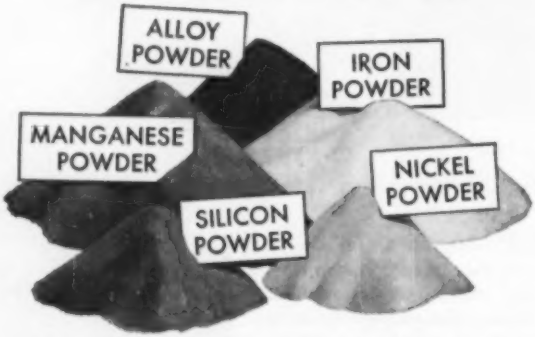

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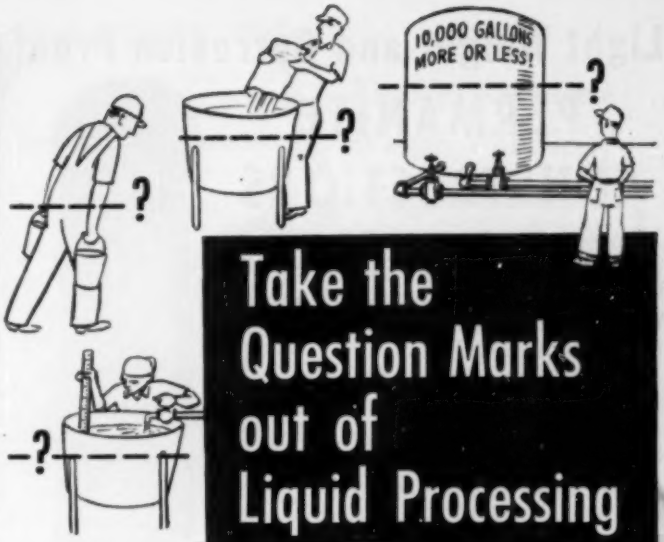

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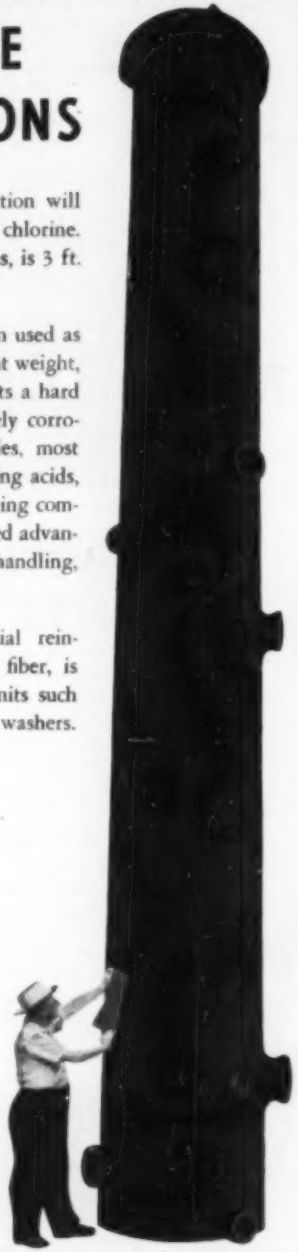

This tower of Permanite Construction will handle HCl, carbon tetrachloride and chlorine. It was built to customer's specifications, is 3 ft. I. D. by 28 ft. high.

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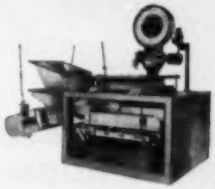

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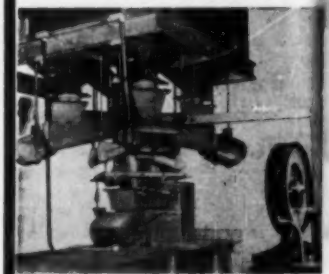

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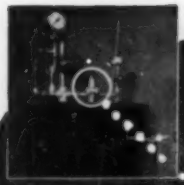

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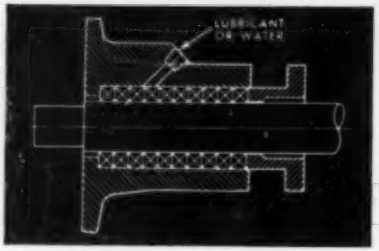

BULLETIN S-147 AVAILABLE

The information about stuffing boxes in this bulletin is designed to suggest solution of common stuffing box difficulties in individual pumping operations. • It offers suggestions on such vital matters as number of rings to use, depth of box, and type of packing. • It points out that chemical and physical properties of the liquid, speed of shaft, pressure, and temperatures are governing factors; that reciprocating piston rods are easier to pack than rotating shafts; that extra-deep boxes are not always the most effective; and that new rings should not be added to packing that has lost its resilience. • Much other valuable information is included. • Please use business stationery when writing for this Bulletin S-147.

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Fig. 645

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INSTRUMENTATION — design development and industrial application of electronic and pneumatic instruments.

INDUSTRIAL AIR-CONDITIONING AND REFRIGERATION — design of plant systems.

CHEMISTS, PHYSICISTS, METALLURGISTS

Research, development, and production in nuclear technology, gaseous diffusion, and related fields.

Minimum educational requirement—
B.S. degree, or its equivalent.

Salary commensurate with training and experience

Give experience, education, age, references, personal history, salary received and salary expected.

Central Technical Personnel Office

CARBIDE and CARBON CHEMICALS COMPANY

a Division of

UNION CARBIDE AND CARBON CORPORATION

Post Office Box P
Oak Ridge, Tennessee

ENGINEERS

Chemical - Mechanical - Piping - Process

Long term openings in permanent offices located at Cleveland, Ohio and Frederick, Maryland offering good salary plus overtime (forty eight hour week) for qualified Engineers, Group Leaders and Designers experienced in one or more of the following phases of industrial plant design:

PROCESS PIPING
INSTRUMENTATION
PROCESS EQUIPMENT LAYOUT
PACKAGING
AIR CONDITIONING
PLUMBING
TANKS AND VESSELS
BOILER HOUSES
PLANT LAYOUT
CONVEYORS
HEATING AND VENTILATION
SPRINKLERS
WATER TREATMENT

Limited number of openings for Estimators experienced in Mechanical and Chemical installations as well as building construction.
Also have a number of openings in our Cincinnati and New York City offices for similar type personnel.
Excellent working conditions with paid vacations, sick leave plan and participating Group Insurance Program.
Please submit complete resume stating experience, education, salary required and date available to:

The H. K. Ferguson Company
Engineers and Builders
Ferguson Building — Cleveland 14, Ohio

VISCOSE ENGINEER

National organization seeks capable graduate engineer with minimum 5 years experience in viscose rayon manufacture. Headquarters New York. Salary high.

Send complete resume including age and salary data

Box CE 463, 221 W. 41 St. New York City 18, N. Y.

WANTED

(Additional Wanted ads on page 416)

WILL BUY

Cancelled - Unshipped - Rejected or Over-Stocked

CHEMICALS—DRUGS
SOLVENTS
PHARMACEUTICALS
OILS—PIGMENTS, ETC.

Chemical Service Corporation
80-04 Beaver St. New York 5, N. Y.

WANTED

To Expedite Production

Process Machinery including Vacuum Dryers, Heavy Duty Mixers, Reaction Kettles, Columns, Rotary Filters, Filter Presses, Pulverizers, Packaging and Wrapping equipment, S/S and non-corrosive Storage Tankage.

Will consider set up plant now operating or shut down. When offering give full particulars.

P. O. Box 1351
Church Street Sta., New York 8, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ASSISTANT HYDRAULIC Engineer with some field experience in construction of hydro-electric power plant projects, etc., for large Copper Company Chile, South America. Civil Engineering graduate preferred. 2-year contract. Transportation both ways and salary while traveling paid by Company. In reply give complete details. P-2572, Chemical Engineering.

ASSISTANT MILL Metallurgist for large Copper Company, Chile, South America. Young college graduate with some experience, to work in Mill Metallurgical Laboratory. 2-year contract. Transportation both ways and salary while traveling paid by Company. In reply give complete details. P-2571, Chemical Engineering.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500 to $25,000. We offer the original personal employment service (established 42 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 260 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. B, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

ANALYST: EXPERIENCED, over, steel and alloys. Laboratory of production Chemist. PW-1888, Chemical Engineering.

CHEMICAL ENGINEER graduate, 1941, desires position with progressive company located in Indiana or surrounding states. Varied engineering experience. PW-2553, Chemical Engineering, 520 N. Michigan Ave., Chicago 11, Ill.

AVAILABLE — CUSTOM REFINING FACILITIES
- Distillation
- Extractions
- Separations
- Fractionations

Drum Lots—Tank Cars

WANTED
- All Types of Crude Mixtures
- By-Products, Residues, Wastes
- Contaminated Solvents

TRULAND CHEMICAL & ENGINEERING CO., INC.
Box 426, Union, N. J. UNionville 2-7360

CHEMICAL PLANT WANTED

We are now manufacturing over $20,000,000 in various lines and wish to expand by acquisition of assets or stock of one or more industrial companies. In our negotiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained.

Address all replies

"Confidential" C. J. GALE, Sec.
233 Broadway, N. Y. 7, N. Y. BA 7-1819

MANUFACTURER'S REPRESENTATIVE

covering Western New York State desire agency for materials, mechanical handling or process equipment saleable to food, chemical, steel and process industries. Seasoned chemical and mechanical engineers with design and sales experience in their respective fields.

RA-2780, Chemical Engineering
330 W. 42 St., New York 18, N. Y.

POSITIONS WANTED

EXECUTIVE CHEMICAL Engineer, B. CH. E., licensed P.E., substantial management experience in production and engineering of electrolytic inorganic and organic operations seeks new connection with broad responsibilities. PW-2666, Chemical Engineering.

PLANT ENGINEER. Chemical-mechanical, professional license, 20 years experience in process industries, development, design, & production. Desires permanent position with manufacturing organization. Wishes to relocate, West Coast preferred. PW-2491, Chemical Engineering, 68 Post St., San Francisco 4, Cal.

PRODUCTION-DEVELOPMENT Chemist, Ph. D., 18 yrs. exp. on detergents, petroleum, organ. design, supervision. Excel. manager plant operations. PW-2678, Chemical Engineering.

PROJECT & STAFF Engr. Rensselaer Polytech. BChE. Age 32, 9-yr. chemical and mechanical engineering background including power plant operation, machine and process development and large heavy chemical plant production surveys, desires position of greater responsibility in chemical manufacturing. West Coast preferred. Salary range $,500 to $,500. PW-2663, Chemical Engineering.

SELLING OPPORTUNITY WANTED

SALESMAN-METROPOLITAN N. Y.—Looking for lines or position dealing with major oil, Chemical, process Accounts—Pumps, Valves, Steam specialties, etc. SA-2492, Chemical Engineering.

CONTRACT WORK

Custom Grinding—Well-established company in New Jersey offers facilities for fine grinding of metallics and non-metallics to flake, chip and grain forms. Specialists in hazardous products. Packing, mixing, and shipping facilities available. CWW-2418, Chemical Engineering.

PATENTS

CONSULT: Z. H. POLACHEK,
Reg. Patent Attorney, 1234 Broadway, New York 1, N. Y.

THE GELB GIRL DECEMBER 1951

KEEP YOUR EYE ON THE BALL

AND LOOK TO

GELB

FOR THE BEST IN VALUE

2—Swenson-Walker Stainless Steel Jacketed Crystallizers, constructed of 316 Stainless Steel, each Crystallizer equipped with 4-10' sections.
5—Dowington Stainless Steel Heat Exchangers, 500 sq. ft. each.
1—Nickel Jacketed Vacuum Kettle, 65 gal. cap.
2—Stainless Steel Open Top Jacketed Kettles with Stainless Steel Jacket, 20 and 50 gal. cap.
2—Stainless Steel Packed Columns 30" x 32'.
1—Stainless Steel Hydrogenator, 360 cap. 250 lbs. PSI.
1—Niagara Stainless Steel Filter, 146 sq. ft.
2—Sperry Rubbed Covered Plate and Frame Filter Presses, 24" x 24" Open Delivery, 14 Chambers.
2—Stainless Steel Jacketed Vacuum Kettles, 250 gal. cap.
1—Nickel Jacketed Kettle, 400 gal. cap.
1—Nickel Jacketed Vacuum, 10 gal. cap.
1—Stainless Steel Jacketed Vacuum Kettle with agitator, 250 gal. cap.
1—Stainless Steel High Pressure Kettle, 360 gal. cap.
1—Readco Stainless Steel Jacketed Double Arm Mixer, 150 gals. cap., with Sigma Blades.
4—11,000 gal. cap. Type 316 Stainless Steel Storage Tanks.
7—1,500 gal. cap. Type 316 Stainless Steel Storage Tanks.
5—Sharples #16-Y Stainless Steel Centrifuges.
1—Sperry Heresite Filter Press, 36" x 36", Plate and Frame, 4 Eye, Closed Delivery.

3—Mikro Atomizers, Stainless Steel construction, #5 & #6.
1—Plaudler Glass-lined Evaporating Dish, 12 gal. cap.
1—Sperry Bronze Plate & Frame Filter Press, 18" x 18", 21 chambers.
4—Rubber-lined Storage Tanks, 1,000 gals. cap. each.
1—Tolhurst Stainless Steel Suspended type Centrifuge 40" Imperforated Basket.
18—Sharples Super Pressurite Centrifuges #6.
1—Sharples Super Pressurite Centrifuge, Stainless Steel Bowl, Model #16Y.
1—Jacketed Vacuum Autoclave, 800 gal. cap. with Agitator.
1—Blaw-Knox Jacketed Autoclave 3' x 4'2" with Agitator.
1—Blaw-Knox Jacketed Autoclave, 800 pal., 3' x 4' with Agitator and Motor Reducer.
2—Blaw-Knox Jacketed Autoclaves with Agitator, 300 and 500 gal. cap.
1—Gemco Copper Conical Blender, 3½ cu. ft.

1—Kewanee 125 H.P. Boiler, 125 lbs. pressure.
2—Black & Clawson Double Drum Dryers, 28' x 5'.
1—Louisville Rotary Steam Tube Dryers, 6' x 50'.
2—Buflovak Vacuum Drum Dryers, 24" x 20".
2—Buflovak Vacuum Drum Dryers, 5'10" x 12".
5—Louisville Rotary Steam Tube Dryers, 6' x 25'.
1—Buflovak Double Drum Dryer, 22" x 90".
1—Fitzpatrick Stainless Steel & Bronze Model Comminuting Machine.
1—Artesian Metal Works Steel Jacketed Kettle, 1000 gal. cap. with agitator.
1—Ross 50 gal. cap. Change Can Mixer.
3—Shriver Cast Iron Filter Press, 36" x 36", Closed Delivery, 25 & 36 Chambers.
1—Sperry Cast Iron 30" x 30" Filter Press. Recessed Type, 55 Chambers, Open Delivery.
6—Cast Iron Jacketed Kettles, 210 to 600 gal.
1—J. P. Devine Vacuum, Jacketed Kettle, 2500 gal. cap.
9—Steel Electrically Heated Kettles, 430, 900 & 1000 gal. cap.
1—Banbury Mixer #1 with 50 Hp motor.
3—Baker Perkins Double Arm Mixers, 200 gal. cap., sigma blades.
2—J. H. Day Mogul Type Mixers, 3½ & 5 gal. cap.
5—Simpson #18 Intensive Mixers, "Unused".

1—Patterson Porcelain Lined Pebble Mill, Type D, with 25 HP motor.
3—Hardinge Conical Ball Mills, 9' x 30", 5' x 22" and 6' x 22".
1—Abbe Engineering Silex-Lined Pebble Mill, 6' x 12'.
2—Mikro Pulverizers #1 SH.
1—Mikro Stainless Steel Pulverizer #2 TH.
2—Copper Columns, 36" x 80'.
1—J. H. Day #71 Re-Ball Jacketed Stainless Steel Gyrating Screen Cooler.
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1—Royal #1 Perforated Extruder, with heating unit.
4—Steel Heat Exchangers, 800 sq. ft. each.
4—Sperry 36" x 36" Recessed Type Filter center-feed, open-delivery, 42 Heresite covered Plates.
1—Sperry Aluminum Filter Press, 18" x 18", 8 Chambers.
1—Shriver Cast Iron Jacketed Plate & Frame Filter Press 36" x 48", 49 Chambers.
1—Sperry Aluminum Filter Press, 24" x 24", 24 Chambers.
1—Sprahlex Stainless Steel Filter Model #18-S-12.
2—Shriver 36" x 36" Plate & Frame Filter Presses, 21 Chambers.
1—Shriver 36" x 36" Plate & Frame Filter Press, Closed Delivery, 35 Chambers.

Established 1856

R. GELB & SONS, Inc.,

CHEMICAL, RUBBER, OIL, PLASTIC and FOOD PROCESSING MACHINERY

STATE HIGHWAY No. 29, UNION, N. J. · UNionville 2-4900

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PLANT LAYOUT
CONVEYORS
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SPRINKLERS
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Ferguson Building — Cleveland 14, Ohio

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SOLVENTS
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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

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CHEMICAL ENGINEER graduate, 1941, desires position with progressive company located in Indiana or surrounding states. Varied engineering experience. PW-2552, Chemical Engineering, 520 N. Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

EXECUTIVE CHEMICAL Engineer, B. CH. E., licensed P.E., substantial management experience in production and engineering of electrolytic inorganic and organic operations seeks new connection with broad responsibilities. PW-2666, Chemical Engineering.

PLANT ENGINEER. Chemical-mechanical, professional license, 20 years experience in process industries, development, design, & production. Desires permanent position with manufacturing organization. Wishes to relocate West Coast preferred. PW-2491, Chemical Engineering, 68 Post St., San Francisco 4, Cal.

PRODUCTION-DEVELOPMENT Chemist, Ph. D., 18 yrs. exp. on detergents, petroleum, organ. design, supervision. Excel. manager plant operations. PW-2675, Chemical Engineering.

PROJECT & STAFF Engr. Rensselaer Polytech. DChE. Age 32, 9-yr. chemical and mechanical engineering background including power plant operation, machine and process development and large heavy chemical plant production surveys, desires position of greater responsibility in chemical manufacturing. West Coast preferred. Salary range 6,000 to 8,500. PW-2682, Chemical Engineering.

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CONTRACT WORK

Custom Grinding—Well-established company in New Jersey offers facilities for fine grinding of metallics and non-metallics to flake, chip and grain forms. Specialists in hazardous products. Packing, mixing, and shipping facilities available. CWW-2418, Chemical Engineering.

PATENTS

CONSULT: Z. H. POLACHEK.
Reg. Patent Attorney, 1234 Broadway, New York 1, N. Y.

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- 2—Stainless Steel Open Top Jacketed Kettles with Stainless Steel Jacket, 20 and 50 gal. cap.
- 2—Stainless Steel Packed Columns 30" x 32'.
- 1—Stainless Steel Hydrogenator, 360 cap. 250 lbs. PSI.
- 1—Niagara Stainless Steel Filter, 146 sq. ft.
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- 1—Nickel Jacketed Kettle, 400 gal. cap.
- 1—Nickel Jacketed Vacuum, 10 gal. cap.
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- 4—11,000 gal. cap. Type 316 Stainless Steel Storage Tanks.
- 7—1,500 gal. cap. Type 316 Stainless Steel Storage Tanks.
- 5—Sharples #16-Y Stainless Steel Centrifuges.
- 1—Sperry Heresite Filter Press, 36" x 36", Plate and Frame, 4 Eye, Closed Delivery.

THE GELB GIRL DECEMBER 1951

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1—Sperry Bronze Plate & Frame Filter Press. 18" x 18", 21 chambers.
4—Rubber-lined Storage Tanks, 1,500 gals. cap. each.
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10—Sharples Super Pressurite Centrifuges #6.
1—Sharples Super Pressurite Centrifuge, Stainless Steel Bowl, Model #18Y.
1—Jacketed Vacuum Autoclave, 600 gal. cap. with Agitator.
1—Blaw-Knox Jacketed Autoclave 3' x 4'2" with Agitator.
1—High Pressure Steel Autoclave, 900 psi., 3' x 4' with Agitator and Motor Reducer.
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3—Buflovak Vacuum Drum Dryers. 24" x 30".
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3—Baker Perkins Double Arm Mixers, 200 gal. cap., sigma blades.
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4—Steel Heat Exchangers, 900 sq. ft. each.
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1—Shriver Cast Iron Jacketed Plate & Frame Filter Press 36" x 48", 49 Chambers.
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Established 1856

R. GELB & SONS, Inc.,

CHEMICAL, RUBBER, OIL, PLASTIC and FOOD PROCESSING MACHINERY

STATE HIGHWAY No. 29, UNION, N. J. · UNionville 2-4900

Resin and Chemical Mfg. Installation!
consisting of
250 Gal. Monel Reactor; 30" x 48"; jacketed and agitated; XPL motor with S.S. Condenser 100 sq. ft.
200 Gal. Stainless Vacuum Receiver
754 Gal. Monel coiled Tank; 9' x 9'
479 Gal. Stainless Jacketed and agitated Sulphonator
95 Gal. S.S. Agitated Mixing Tank
700 Gal. Lead Lined Agit. Mixer
15 Gal. Pfaudler Glass Lined Jacketed and agitated Reactor with condenser and 15 gal. Glass Lined Vacuum Receiver
Complete with interconnecting piping, valves, controls, instruments, etc.

PEBBLE MILLS in STOCK
5—International 5' x 5' Porcelain Lined Mills with 50 HP Gen. motors; like new condition
12—Pebble Mills ball-stone lined by Paul Abbe and Abbe Engineering: 3' x 4'; 4' x 3'; 4'6" x 5' and 5' x 6' with or without motors as desired

SELECTED ITEMS from STOCK
Struthers Wells, S.S. Heat Exchanger, 1000 sq. ft.
Buflovac 20 Shelf Vacuum Chamber Dryer complete with accessories
Doppley by Sowers Cast Iron Vacuum Reactor Jacketed; 42" x 84"
2 Type 316 Stainless 50 gal. Jkt'd. Agitated Reactors
1500 Gal. Welded Steel Jacketed and Agitated Reactor; 10' x 10'6"
Pfaudler 5000 Gal. Vertical Jacketed Steel Tank; 9'9" x 9'10½"
Shriver and Sperry Filter Presses, Cast, Alum. Rubber covered up to 36"
Lancaster Model EA84 Muller type Mixer complete with accessories
4 Horizontal Autoclaves or Dryers with trucks; 5' x 14'
4 Bird Young Rotary Vacuum Filters 24" x 48" and 32" x 48"
Oliver Borron Rotary Vacuum Filter; 6' x 3'; nickel sheets
Squier Rotary Atmospheric Dryer; 30" x 20'; Type 347 Stainless clad
Louisville Counter Current Monel Dryer; 32" x 10'
3 Stokes 16 Shelf Steam Heated Drying Cabinets; 3' x 3' x 5'
1 Steel Rotary Vacuum Dryer; 4' x 8' I.D. with drive etc.
Proctor & Schwartz Continuous Apron Dryer; 40'

LIQUIDATING LARGE ORGANIC CHEMICAL INSTALLATION
6—Gaslis Birmingham EVAPORATORS from single to sextuple effect; long tube type in steel
3—All copper Calandria type Evaporators; double, triple and quadruple effects
3—Bronze Vacuum Drum Dryers, 8' x 10'
1—Chrome Plated Vacuum Drum Dryer 5' x 10'
24—Hi Pressure cold brick lined Digestors or Autoclaves
2—No. 12 Sweetland STAINLESS Pressure Filters
30—Large Wood Tanks up to 20,000 gal. each; 4' diam.
Heat Exchangers, Condensers, Valves and 10 Miles of Copper Pipe from ¼" to 6" IPS

HAMMERMILLS in STOCK
Mikro, Raymond, Greenlee, Williams, Robinson, American Pulverizers and Hammer Mills of all types for every purpose; horsepowers up to 150 HP; largest stock in our history of this type of equipment. Inquire about your grinding or pulverizing problem.

FIVE GOOD REASONS FOR RELEASING YOUR IDLE EQUIPMENT RIGHT NOW!
1. Unload your idle assets for Tax "write-offs" before inventory.
2. Give your plant more breathing space and operating efficiency by disposing of non-productive material.
3. Good USABLE equipment is sorely needed by vital defense plants for increased production . . . idle machines work for the foe.
4. Idle and UNUSABLE material should go to the Steel Mills who face shut downs for lack of scrap.
5. Reinvest the cash you realized from the sale of surplus machines in later model, more efficient equipment to improve your production.

RENTAL-PURCHASE PLAN
For a low cost pilot operation, for experimental projects, for a limited budget production, consider the FMC Rental Purchase plan. Eye it, try it, and then buy it if it works out for you. Write for the simple details.

FIRST MACHINERY CORP.
157 HUDSON ST. WOrth 4-3900 NEW YORK 13, N. Y.

SEPARATORS: One Sturtevant 8 ft. and one 10 ft. with extra heavy liners, condition like new, either or both with steel supporting structure.
CLASSIFIERS: 4—Akins 54" and one 30", Simplex, single screw, Weir type, with 440 volt, AC motors.
DRYERS or KILNS: 2—Allis Chalmers 10 ft. x 90 ft., heavy duty, plate thickness 22.95 lbs. per sq. ft., complete and with or without coal fired Furnace, Western Precipitation Dust Collector, Clarage #41 Exhauster, Motors, control equipment, etc.
PULVERIZERS: Hardinge Mill size 5 ft. x 22", steel lined, complete with disc feeder and 30 H.P. motor. 1—10 ft. x 36", Hardinge Conical Ball Mill with 300 H.P. motor and all auxiliary equipment for dry grinding. 1—Sturtevant 11½ Ring Roll Mill.
COAL CRUSHER: Jeffrey Flextooth 24" x 42" with Allis Chalmers, type ABZ, 75 H.P. motor, 3 phase, 60 cycle, 2300 volt, 24 hrs., 55 deg., 1170 RPM, with 5 groove V belt pulley.
REDUCTION CRUSHERS: 2—Newhouse 10" with 220/440 volt motors. 1—Symons 2 ft. with coarse bowl, without motor. 1—Symons 3 ft., short head, fine bowl, and one Traylor type TY 2'6" with 9" opening, both with 75 H.P., 440 volt motors, V-belt drive.
COMPRESSOR: Worthington 2 stage, 23/18-½ x 21, type DC2, 600 H.P., synchronous motor, 3 phase, 60 cycle, 440 volt, 180 RPM, cap. 3000 CFM, 100 lbs. pressure, complete with auxiliary equipment. In operation now, available immediately. 1—Worthington 13-8-½ x 12, cap. 700 CFM @ 100 lbs., direct connected to 440 volt, 125 H.P. synchronous motor, with all auxiliary equipment.
DIESEL MOTOR: 132 H.P. Caterpillar D13000 complete with clutch, V-belt pulley and spare parts.
BOOT BUCKET ELEVATORS: 2—62 ft. c.c. manganese steel chain, buckets 10" wide. 1—70 ft. c.c. buckets 8 x 5 on #78 Reliance chain. NEW, UNUSED.
THICKENERS: Acid Proof Thickeners, one 180 ft., one 250 ft. diameter.
AGITATORS: One 30 ft. and one 38 ft.
FILTER: 1—Oliver 14 ft. dia., 16 ft. face.

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2—Tolhurst 48" Center Slung S.S.
1—Fletcher 40" Suspended Stainless Perforated Basket, bottom discharge.
2—Tolhurst 40" Suspended Everdur Perforated Baskets.
1—Fletcher 40" Suspended Steel Solid Basket, bottom discharge.
1—Tolhurst 32" Suspended Monel Perforated Basket, bottom discharge.
2—AT&M 20" rubber-covered underdriven.
1—Sharples P-14 Stainless Steel Super-D-Canter.
2—Bird 36"x30" Solid Bowl, Continuous, rubber-covered.
1—Sharples #16 S.S.

FILTERS

2—Oliver Monel 9' x 10' Rotary Vacuum.
1—Vallez # 40 Pressure Filter, 41 leaves.
1—Sweetland #12, 36 S. S. leaves.
2—Sweetland #7, 27 steel leaves, 2" centers.
1—Sweetland #2, 17 copper leaves, 2" centers.
8—Oliver Rotary Vacuum 11'6" x 14', 6' x 12', 9' x 9'.
4—Oliver Rotary Vacuum Precoat 3' x 4', Steel.
3—Feinc Rotary Vacuum 6' x 12', 4' x 5', 3' x 2'.
1—Feinc Rotary Vacuum 3' x 1' S. S.
1—Shriver 24" Cast Iron P&F, 30 chambers.
1—Shriver 24" recessed, 30 chambers. C. I.
3—Shriver 18" recessed, 30 chambers. C. I.
1—Independent 36" Wood P&F, 28 chambers.
2—Sperry Aluminum 30", 24", P&F, 28 & 22 chambers.
1—Shriver Aluminum 12" P&F, 12 chambers.
10—Shriver, Sperry Skeletons, 42", 30", 24", 18".

PULVERIZERS

1—Raymond 3 Roll Midget High Side Mill.
1—Raymond 3 Roll High Side Mill complete.
1—Bauer 36" Attrition Mill with 2—50 HP motors.
5—Abbe 6' x 8', 4'6" x 3'6", 3'3" x 3'6", 2'6" x 3' Pebble Mills.
7—Patterson 6' x 10', 6' x 8', 4' x 5', 3'6" x 4', 3' x 4' Pebble Mills.
2—Premier Colloid Mills 8" dia. S. S.
1—Eppenbach QV7 Colloid Mill.
2—Jeffrey 24" x 18", 20" x 12" Hammer Mills.
2—Raymond 8', 4' Air Separators.
1—Ball & Jewell #1½ Rotary Cutter.
1—Albert 2 Roll Mill 6" x 12".

SCREENS

5—Sprout Waldron S. S. Single Deck, 48" x 84".
1—Orville Simpson Rotex Double Deck, 40" x 50".
1—Tyler Hummer 4' x 7' Single Deck with V-16 vibrator.
5—Tyler Hummer 3' x 5' Triple Deck with V-16 vibrators.
1—Abbe #2 Blutergess Sifter.

KETTLES—TANKS—EVAPORATORS

5—Steel 2000 gal. jacketed agitated closed 200# Pressure Kettles.
1—Bethlehem 1400 gal. Steel Jacketed Still.
1—Turbo-Mixer 1000 gal. jacketed agitated closed steel Kettle.
1—500 gal. Type 347 S.S. jacketed Kettle, 300# w.p.
1—Pfaudler 200 gal. glass lined jacketed agitated Tank.
3—Dopp 250, 150 gal. jacketed agitated Kettles.
1—Buflovak 300 gal. steel jacketed Kettle, 100# internal pressure.
1—Stokes 200 gal. closed jacketed Steel Kettle.
8—S.S. 20 to 300 gal. jacketed Kettles, NEW.
7—Steel Pressure Tanks 3500, 8200 gal.
1—Buflovak Type VRC, S.S. Single Effect Evaporator, 94 sq.ft.
1—Buflovak 6' dia. Vacuum Crystallizer.
1—Buflovak Type VRC Triple Effect Evaporator, 900 sq.ft.
5—Sections Swenson Continuous Crystallizer.

MIXERS—ALL TYPES

1—Baker Perkins 300 gal. Unidor Mixer Size 18, S.S.
5—Baker Perkins 100, 20 and 9 gals., jacketed.
1—Baker Perkins 2 gal. Stainless, Double Arm.
10—Day, Redgers 200# to 3000# Powder Mixers.
12—Electric Portable Agitators ¼ HP to 5 HP. NEW.
4—Day, Ross, 8 and 50 gal. Pony Mixers.
1—Eppenbach 1 HP Homo Mixer, explosion-proof motor.

DRYERS—KILNS

1—National Drying Machinery 14 Truck steam heated Dryer 1880 sq. ft.
3—Proctor & Schwartz 8 and 6 sections Single Conveyor Dryers.
8—Buflovak, American Desi-Vac Drum Dryers, 42" x 120", 32" x 100", 36" x 84", 32" x 72".
1—Single Drum 60" x 80" Steel Dryer or Flaker.
1—Link Belt 1106-35 Roto-Louvre Dryer 11'6" x 35'.
1—Link Belt #207-8 Roto-Louvre Dryer 2'7" x 8', monel.
3—Ruggles Cole 70" x 45', 70" x 35', 4' x 20' Indirect Heat Rotary Dryers.
5—Direct Heat Rotary Dryers 8' x 60', 7' x 60', 5' x 67', 4'6" x 40', 4'6" x 25'.
3—Rotary Kilns 6' x 125', 8' x 100', 6' x 60'.
1—Brueckner Furnace 6'9" dia. x 11' long, brick-lined.
4—Louisville 6' x 50', 6' x 30', 4'6" x 25' Rotary Steam Tube Dryers.
3—Stokes, Buflovak 30" x 8', 8' x 18', 5' x 30' Rotary Vacuum Dryers.
3—Blaw-Knox S. S. Rotary Vac. Dryers 42" x 8', 42" x 10'.
5—Buflovak Vacuum Drum Dryers 8' x 13', 4' x 8', 24" x 20".

MISCELLANEOUS

12—Bucket Elevators, steel housings, 34' to 90' centers, 8" x 6" to 24" x 8" buckets.
7—Stokes Vacuum Pumps 15 to 100 CFM.
1—Milton Roy Proportioneer Pump, S. S. and Hastelloy, 10 GPM.
1—Oliver Horizontal Dry Vacuum Pump 400 CFM.
5—Devine, Buflovak Condensers and Recovers, 20 to 90 sq. ft.
1—Colton Single Punch Tablet Machine #5½.
4—Stokes DD2, D4, D9 Rotary Tablet Machines.
1—#1 Anderson Expeller.
2—Nash AL672 Hytor Vacuum Pumps.
1—Mitts & Merrill #10 Paper Shredder.
16—Olivite Durizon & Rubber Centrifugal Pumps, 1½" to 4".

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1—Sweetland Filter No. 5, 15 leaves.
1—Sperry Filter, 18 x 18, 24 plate.
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1—300 gal. Steam Jacketed Double Arm Mixer.
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1—42" x 16" Allis-Chalmers crushing rolls.
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1—5' Raymond Whizzer separator.
1—4' x 8½', 3 deck, Robins "Gyrex" screen.
8½' x 60', 7½' x 60', 7' x 60', 6' x 60', 5' x 25', 4' x 30' and 3' x 30' dryers.
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4—Atmospheric Truck Dryers, Brilsonair, each 8'6" x 16' x 8'3" high, with Trane heating Units, motor driven, blowers, etc.
1—3' x 26' MONEL shell hot air Dryers, saw tooth flights, steam coils, etc.
2—5'6" x 24' Direct Heat Rotary Dryers or Rotary Kilns, welded shell.
1—7' x 70" Louisville Type L, Indirect-Direct Heat Rotary Dryer.
1—10' x 90' Allis Chalmers Rotary Dryer or Cooler.
1—Devine #7 Vacuum Shelf Dryer, 13 shelves 40 x 43.
2—Buflovak Double Drum Dryers 32" x 90" complete.
1—Devine Rotary Vacuum Dryer, 2' x 8', also 5' x 25'.
2—Buflovak Vacuum Drum Dryers, 5' x 10' with all accessories.
1—6' x 50' Louisville welded shell Rotary Steam Tube Dryer with two rows, 54 tubes. Also two 6' x 27' Davenport, same type.

MIXERS

4—Baker Perkins, jack. Mixers, 3,000 gal., size 30, type X.
1—100 gal. jack. W. & P. Mixer, heated blades.
10—Baker Perkins, jacketed, heavy duty, 10 gal. to 500 gals.
1—50 gal. jacketed W. & P. Mixer, M.D.
1—Patterson 110 gal. S.S. Vac. Kneadmaster.

JACKETED KETTLES

65—Aluminum & Stainless Steel, 20 gal. to 150 gal.
1—500 gal., open.
2—750 gal.
1—5,000 gal., steel, closed, agit.

ROTARY KILNS

1—8' x 110'; 3—7' x 110'; 2—6' x 110'.

FILTERS & FILTER PRESSES

1—Sperry, iron, steam heated, 30" x 30", 30 chambers.
6—Shriver & Johnson 30 x 30 iron plate and frame, 35-40 chambers each.
1—36" Sperry C. I. FILTER PRESS, recessed, open delivery, 60 chambers, 1½" ea., pump, explosion-proof motor.
1—8' x 12' ALL STAINLESS STEEL Feinc Rotary Continuous Vacuum Filter, string discharge, with blankets and STAINLESS STEEL trough, repulper, receivers, vacuum pump, motors, reducers, etc. ETAO #387.
1—8' x 12' Oliver Lead-Wood Vacuum Filter, Acid-Resisting.
3—Oliver Vacuum Filters, incl. 8 x 12', 11'6 x 14', 11'6 x 18'.
2—ALUMINUM Sperry FILTER PRESSES: 1—30" x 30" 45 chambers, 1—24" x 24" Plate and Frame, 24 chambers.
1—#12 Sweetland Filter, 36 leaves on 4" centers.
1—Kilby 39 x 39 CI Filter Press, open delivery.
1—#5 Sweetland, Stainless Steel Lined, with 30 stainless steel leaves, on 2" centers.

STAINLESS STEEL CENTRIFUGALS

2—42" All Stainless Steel Centrifugals, Amer. T&M Co., each with S/S basket, curb, casing, shaft unloader, and 40 H.P. variable speed Slip Ring 3/60/440 V. 1200 RPM motor with full controls. Suspended bottom discharge type. Now at Newark.

CONTINUOUS CENTRIFUGALS

1—36" x 40" Bird-Laughlin Continuous Centrifugal horizontal slotted bowl with stainless steel internal screens. With 25 HP motor.

MISCELLANEOUS

2—Swenson copper tube Evaporators, 1—triple effect, total 1330 sq. ft. H.S. 1—single effect, 422 sq. ft. H.S. Installation complete with interconnecting steel framework, pumps, etc.
500—Stainless Steel Dryer Trays, 34" x 34" x 1½" deep.
1—Copper Rectifying Column, 6 sections, 30" dia. x 33' high, bubble cap type.
6—Ross 20 gal. heavy duty Pony Mixers.
1—Abbe 175 gal. Buhrstone-Lined Pebble Mill.
15—Dry Powder Mixers and Blenders, rotary and horizontal ribbon type, 100 to 5000 lb.
1—Pneumatic Scale Automatic Packaging Unit, incl. Tight Wrap, 32 per minute.
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1—6" x 15" Sturtevant Jaw Crusher to ½".
1—24" x 15" Set Sturtevant Crushing Rolls, balanced type.
1—S-Roll Raymond High Side Pulverizer.
1—Gedge Gray 5,000# jack. Pow. Mixer.
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4'x5'x30' (2).

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Bird 40"x60" Cont. solid bowl, rubber lined.
Bird 40" SS, suspended, perforated.
Bird 36"x30" Cont. solid bowl, rubber covered.
Bird 24" Cont. Type CH, Series 200.
Bird 18"x28" Cont. solid bowl w/motor.

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One unit with 2—8'x15' scraper mechanism, w/external heating coils.

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Turbulaire N2 with filter.
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Spray 3'x6' Laboratory, sta. steel, elec. heated.
Vacuum Shelf 2'11 Device, 170 sq. ft. surface.
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Buflovak 5'x5' Atmos. single drum.
(FOR ROTARY DRYERS, SEE KILNS)

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30" Sperry, Type 47, 26 frames, hyd. closure.
8'x12' Feinc, all steel.
8'x10' Oliver, wood & steel (3).
11'6"x18' Oliver, all steel.
27 Sweetland, 2" spacing, 28 leaves avail.
36" Filter Press, open del., 27 chambers, wood plates.

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6'x8' Patterson, Pebble.
6'x8' Abbe Style GPH, Pebble.
16"x40" Day, 3-roll, Ink.
Abbe Size 8 Grinding.
Kombinator, Flow Master K Model 200, 7½ HP drive.

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40 gal. SS clad, jack'd, 40# hinged covers (6).

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HAVEG.
KARBATE.
STAINLESS STEEL TUBING—4" type 304.

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Complete plant vaporizing & mixing equipment, including 18,000 gal. storage capacity in 3—6,000 gal. tanks, ASME U69, 200 PSI working pressure.

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7'x60'x⅜" with lifters.
6'x14'x9/16" Struthers-Wells (2—NEW).
5'x67'x5/16" with lifters.
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10,500 gal. 9'x23'x⅞", 150 PSI.
10,400 gal. 7'x37', 300 PSI test.
8,200 gal. 6'x40'x2", 390 PSI.
3,500 gal. 5'x23'x¾", 200 PSI (4).
2,000 gal. 5'x14', 106 PSI.
1,250 gal. 3'10"x14', 106 PSI.
1,200 gal. 3'10"x13'9", 106 PSI.
1,050 gal. 3'10"x11'9", 125 PSI.

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3,000 gal. 5'x"16"x¼", Type 430.
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6,500 gal. 76"x26'7" sheet 11/16" & 5/16".

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4'x10', hor., agitated (2).

MISCELLANEOUS
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FEEDERS—Vibrating, Syntron F350.
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PUMP—Nash Hytor #9.
VESSELS—4'x10', hor. jack'd., agit. (2).
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1—Shriver 24" C.I. Filter Press 30 Ch.
1—Shriver 36" C.I. Filter Press 36 Ch.
1—Shriver 42" C.I. Filter Press 26 Ch.
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HARDINGE MILLS—5' x 22", 7' x 48", 8' x 22", 10' x 26". All Motor driven.
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CRUSHERS ROLL—12 x 12, 20 x 12, 48 x 16, 54 x 20.
SKIDS—1000, Wood top, Steel Reinforce—11"H.—42" x 54".
FORK LIFT TRUCKS—2000#, & 7500#, Gas.
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CONICAL BLENDING SYSTEM—4 units, 360 cu. ft.
PUMPS—NEW, Centrifugal to 750 gpm.

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HEROULT
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GLASS LINED TANKS — USED — 3000 gallon capacity. Welded construction—Fully insulated. Equipped with manhead. Suitable for milk, food products, lily white chemicals, solvents and fine lacquers.

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Vacuum Pan: 6' Harris stainless steel.
Mixer: Struthers-Wells 4x8' jack., closed.
Powder Mixers: 100 to 2000 lb. capacities.
Pebble Mills: 200 gal. Patterson hubrstone lined.
Mills: 3-roll biaxed and six-speed.
Colloid Mills: Premier, Charlotte, Eppenbach.
Oil Purifier: De Laval No. 600.
Filters: Sparkler models 15-S, 14-M-S, st. st.
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1—Mill: Hardinge 5' x 30" hubrstone lined.
Dryers: 8 x 12' Buflovak vacuum drum.

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1 Illinois Water Treating System, 500 GPM flow rate, complete with Zeolite tank, controls, etc.
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1 Mikro Pulverizer—#211.

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10 Filter Presses, 12" to 36", C. I., P&F.
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1 Vacuum Pan Dryer or crystallizing Kettle, 10' dia. x 3' deep.
2 Pan Dryers or crystallizing Kettles, 10' dia. x 3' deep and 5' dia. x 30" deep.
1 Stokes #58A Vacuum Rotary Dryer, 18" dia. x 42" long, with pump and condenser.
2 Atm. Double Drum Dryers, 22" x 36".
1 Cummer Rotary Indirect Hot Air Dryer, 4' dia. x 30' long, complete.

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Foot of Alexander St., Peoria, Ill.

1—42" dia. Copper Rectifying Column, 21'2" high, 37 bubble cap plates.
3—Copper Condensers; 75 sq. ft., 340 sq. ft.
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1—Hehle 2-roller mill, 9" x 22".
1—Barnard & Leas 3-pair high roller mill, 9" x 18".
1—Westinghouse Air Compressor #4YCH-17, 33 CFM PD @ 175# Pr., 7½ HP mot.
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4—Screw Conveyors: 9" x 15', 9" x 13', 12" x 25½', 12" x 21'.
8—Vertical Agitator Drives, 1 HP G.E. Gearmotors, 3/60/220—440/60 RPM shaft speed.
Contact Mr. Zarow at Peoria 2-4524.

1 Porter heavy duty jacketed double worm mixer—75 gal.
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1 Broughton Powder Mixer, double arm, 2400#.
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8—Stokes Rotary Pellet Presses, 18 punch—B-2, D-3, D-4.

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20# Jacket—Vertical Agitators
3—2700 gal. cap. 7'6" dia. x 7'6" high.
2— 950 gal. cap. 63" dia. x 78" high.
Type 347 stainless steel shell, bolted cast iron top.

70 Stainless Steel and Stainless Clad open top, steam jacketed kettles—10, 40, 85, 80, 100, 150, 250, 500 gal. sizes.
30 Stainless Steel, type 304, tanks — 6, 30, 50, 60, 100, 150, 400, 500, 800, 1000, 1400, 2000, 3500, 5700 gal. sizes.
1 Stainless Steel, type 347 Autoclave or pressure tanks; 25# pr. Elec. heated 850° F; 100 gal. cap., 17¼" dia. x 9' high.
5 Aluminum Tanks 500, 1100, 1250 & 1485 gal.
1 Glass Lined Kettle, Jkt'd. & Agit. 50 gal.
1 Pfaudler 1 gal. Glass Lined Autoclave, 500# Pr., Agitated, Gas Fired.
1 Steel Autoclave, 130 gal., 29" dia. x 74" deep, 125# int. pr. 15# jkt. pr.

5—Vertical Jacketed Pressure Tanks—steel — 30# steam jacket — 6mm vacuum internally:
3—34" ID x 15' H (approx. 700 gal.)
1—23" ID x 10' H (approx. 230 gal.)
1—23" ID x 9' H (approx. 195 gal.)

2 Suspended 48" dia. Basket centrifugals, Bird & Troy.
2 DeLaval #600 Oil Purifiers.
2 Copper Vacuum Kettles, 48" dia., jacketed, agitated.
1 Copper Vacuum Evaporating Pan, 6' dia.—jacketed and coils.
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Extra 36" & 40" iron plates & frames.
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Davies 1000 gal. closed jack agit. steel kettle.
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2—Rotex Sifter 28" x 84", 4 Surface.
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5—Pebble Mills 40 to 500 Gal.
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HIGH SPEED Roller Mills 9"x24" to 10"x40".
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Cone bottom; 11' 10 dia. X 42' overall length; shell thickness 1⅛", head 1½"; ASME Code PAR U-68; 150 p.s.i. working pressure; 300 p.s.i. test Pressure. Excellent condition. Recently inspected by Pittsburgh Testing Laboratory. Contact
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5000 Gal. Steel Reactor, Jkt'd, for 200# Pressure, 200# Int. Pressure, Agtd., Complete with 15 HP Motor
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S.S. Fitz Mill, Model D, 5 HP AC Motor
2 New Steel Vacuum Reactors, 60" x 48"
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60" x 35' & 70" x 45' Indirect Heat Buflo-Coles Direct Heat; 4' x 30', 4' x 45', 4½' x 60', 5' x 50', 6' x 35, 6'8" x 60', 7' x 50', 8' x 70' & 10' x 90'.

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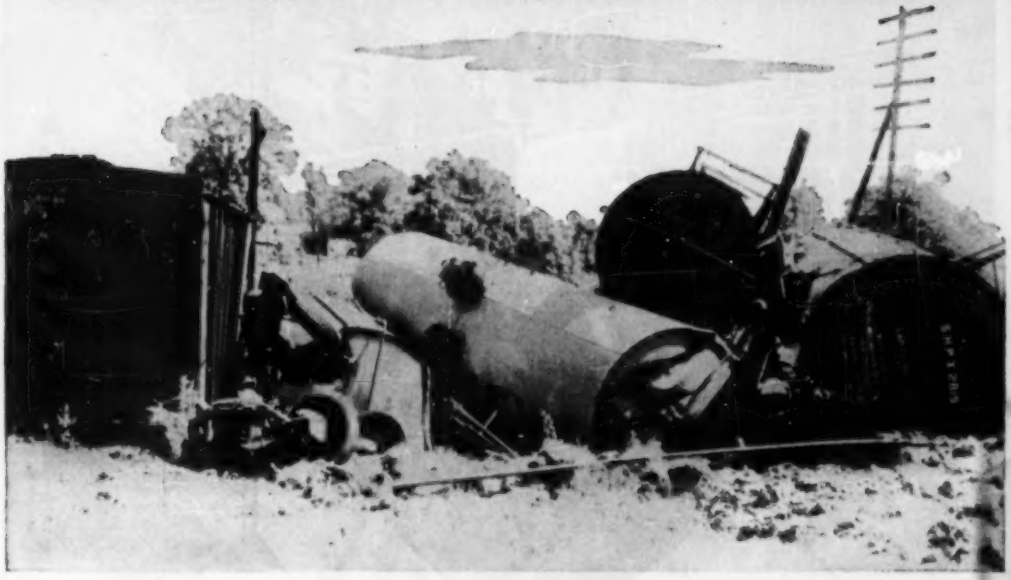

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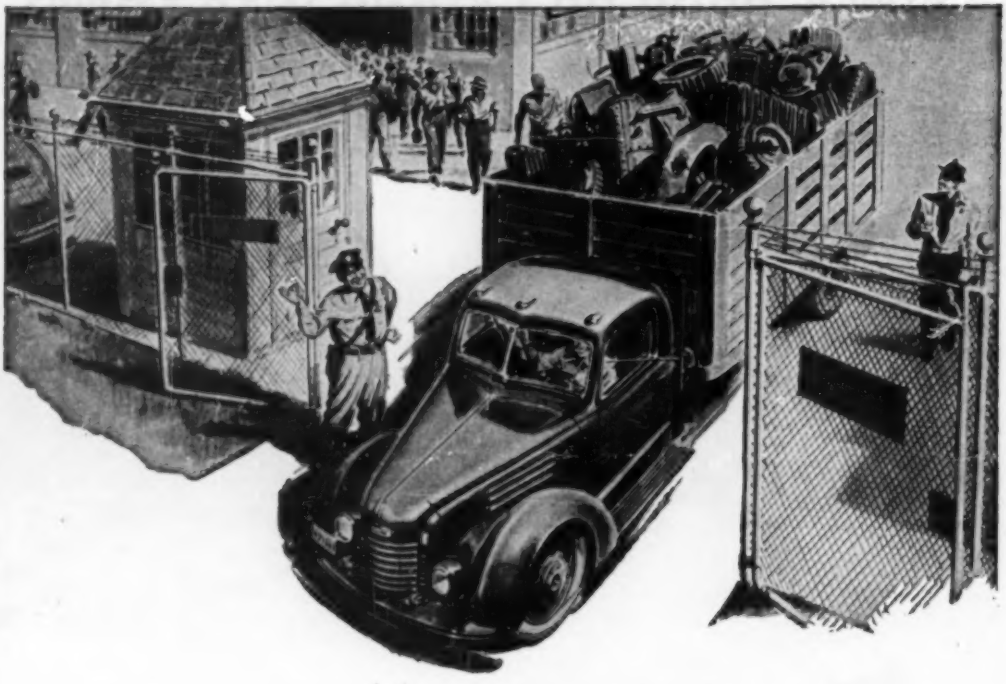

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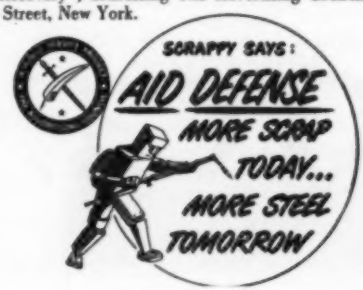

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SEARCHLIGHT SECTION
(Classified Advertising)

EMPLOYMENT
Positions Vacant 407, 408
Positions Wanted 408
Selling Opportunities Wanted 408
Employment Agency 407
Employment Services 408

BUSINESS OPPORTUNITIES
Wanted 408

EQUIPMENT
(Used or Surplus New)
For Sale .....

WANTED
Equipment 408, 416
Miscellaneous 408

ADVERTISERS INDEX

Aaron Equipment Co. 414
American Air Compressor Corp. 415
American Cyanamid Co. 416
Barcan Co., Irving 416
Bauer, L. W. 416
Brill Equipment Co. 411
Celanese Corp. of America 407
Chemical Service Corp. 408
Consolidated Products Co., Inc. 413
Drake Personnel, Inc. 407
Duluth Iron & Metal Co. 410
Equipment Clearing House, Inc. 416
Ferguson Co., Inc., The H. K. 408
First Machinery Corp. 410
Foster-Wheeler Corp. 407
Gale, C. J. 408
Gelb & Sons, Inc., R. 409
Haydn Chemical & Equipment Exchange 412
Heat & Power Co., Inc. 414
Heineken, W. P. 412
Jacobowitz, Charles S. 414
Kehoe Machinery Corp. 416
Kinslow Power Equipment, Inc. 410, 416
Lawler Co. 414
Loeb Equipment Supply Co. 415
Loeb & Son, H. 412
Luria Steel & Trading Corp., Erman-Howell Div. 415
Machinery & Equipment Corp. 414
Miami Valley Coated Paper Co. 416
O'Brien Machinery Co., The 412
O'Neill, A. J. 410
Opell Metal Associates 416
Perry Equipment Corp. 415
Reinertsen, A. B. 414
Solvay Process Div., Allied Chemical & Dye Corp. 407
Stanhope, Inc., R. C. 416
Stein Equipment Co. 416
Strichler & Assoc., Dean G. 412
Superior Equipment Co. 412
Thompson Co., Inc., J. Parker 416
Truland Chemical & Engineering Co. 408
Union Carbide & Carbon Corp. 407
Union Standard Equipment Co. 412

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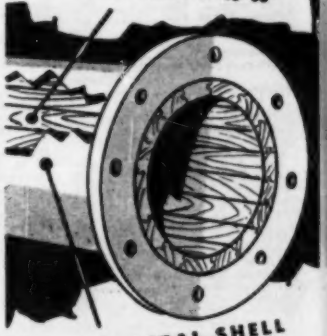

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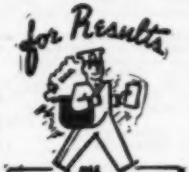

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For more information about products of these advertisers, use Reader Service postcard in section following

Acme Coppersmithing & Machine Co. 187
Air Preheater Corp. 124
Albert Pipe Supply Co. B340
Aldrich Pump Co., The 297
AllMetal Screw Prds. Co. B356
Allis Chalmers Mfg. Co. 12, 68, 105, 175
Alloy Steel Products 15
Aluminum Co. of America 37
Amercoat Corp. 237
American Car & Foundry 417
American Cyanamid Co. 28–29
American Flange & Mfg. Inc. 312
American Gas Assoc. 285
American Hard Rubber Co. 181
American Locomotive Co. 63
American Metal Hose 334
American Optical Co. 6
Armstrong Cork Co. 68
Arrow-Hart & Hegeman Elec. Co. 300
Atlas Mineral Products Co. B272
Atlas Powder Co. 346
Autoclave Engineers Inc. B338
Automatic Sprinkler Co. of Amer. 264

Babcock & Wilcox Co. 118–119
Babcock & Wilcox Tube Co. 24–25
Bailey Meter Co. 377
Baird Associates Inc. 219
Baker & Co. Inc. 7, 282
Barco Mfg. Co. 345
Barnstead Still & Steriliser Co. 302
Barrett Div., Allied Chemical & Dye Corp. 70
Bersworth Chemical Co. 368
Bethlehem Steel Co. 360
Bird Machine Co. 9
Birmingham Committee of 100 294
Black, Sivalls & Bryson Inc. 336
Blaw Knox Const. Co. 241, 394
Boston Woven Hose & Rubber Co. 364
Bridgeport Brass Co. 22
Bristol Company 373
Brookfield Engrg. Labs. Inc. LT399
Brown & Root Inc. 218
Buell Engrg. Co. 369
Buffalo Forge Co. 16
Buffalo Meter Co. 404
Buffovak Equipt. Div. Blaw-Knox 263
Builders-Providence Inc. RT402
Burgess-Manning 36

Cambridge Wire Cloth Co. 206
Cameo Products Inc. 262
Carbide & Carbon Chemical Co., Div. Union Carbide & Carbon Corp. 201
The Carburundum Co. 48–49
Carpenter Steel Co. 251
Carrier Corp. 280
Cash Co., A. W. 207
A. W. Cash Valve Mfg. Corp. RB404
Celanese Corp. of America. 18
Century Electric Co. 86
Chapman Valve Mfg. Co. 90
Chemical Construction 284
Chem. Steel Const. Co. 405
Chicago Bridge & Iron Co. 14
Chicago Eye Shield Co. L402
Chicago Pneumatic Tool Co. 288
Childers Mfg. Co. 20–21
Cleaver-Brooks Co. 189
Cleveland Worm & Gear Co. 109
Combustion Engrg. Superheaters, Inc. 22–23
Consolidated Chemical Industries 378
Corning Glass Works 91
Crane Co. 213
Crouse-Hinds Co. 128–129
Crucible Steel of America. 225
Cuno Engrg. Corp. 361

Dampney Co., The R403
Darco Dept. Atlas Powder Co. 248
Darnell Corp. Ltd. L395
Davison Chemical Corp., The 44
Day Co., The 280
DeLaval Separator 260
DeLaval Steam Turbine Co. 381
Diamond Alkali Co. 327
Diamond Power Specialty Corp. 38
Dings Magnetic Separator Co. 375
Dodge Mfg. Corp. 389
Dorr Co. 202–203
Dow Chemical Co. 60, 243, 288–289
Downingtown Iron Works Inc. B246
Draco Corp. 265
E. F. Drew & Co., Inc. 121
DuPont de Nemours. 255, 287
Duralay Co. 221
Durametallic Corp. 332
Duriron Co. Inc. 271

Eastern Industries Inc. T320
Ebert Electronics Co. LB392
Elliott Co. 79, 233
Enjay Co. Inc. 71

Fairbanks-Morse Co. 98–101
Farrell Birmingham Co. Inc. 92
Fenwal Inc. 39
Ferguson, H. K. Co. 436
Filtration Engineers Inc. 120
Fisher Governor Co. 114–115
Fletcher Works Inc. 437
Flexitallic Gasket Co. 212
Floridin Co. L382
Foote Bros. Gear & Machine Corp. 279
Foster Engrg. Co. 325
Foster Wheeler Corp. 94–95, 247
Foxboro Co., The 85
Frigx Inst. Div. of Bendix Aviation Corp. B250
Fuller Co. 387

General Amer. Transp. Corp. 179, 217, 315
Gen. Chem. Div. Allied Chem. & Dye Corp. 111
General Electric Co. 106–107, 126–127, 245, 319, 365
General Ind. Development Corp. R398
General Radio Co. 62
Gerrard & Co. LB403
Globe Steel Tubes Co. 19
The B. F. Goodrich Co. 12
Goodyear Tire & Rubber. 17
Goulds Pumps Inc. 301
Graver Water Conditioning Co. 58
Greer Hydraulics Inc. 291
Gunthard Co., A. 374

Hagan Corp. 339
Hammond Bag & Paper. T246
Harbison-Walker Refractories Co. 80
Hanovia Chemical & Mfg. Co. 192
Hardinge Co., The 344
H. M. Harper Co. B322
Harrisburg Steel Corp. L401
Heineken, W. P. 405
Helicoid Gage Div., Amer. Chain & Cable Co. 226
Hennsey Co. T332
Hercules Powder Co. 302
Homestead Valve Mfg. Co. 311
Hooker Electrochemical Co. 51
Hough Co., Frank 367

Illinois Water Treatment Co. 302
Ingalls Iron Works Co. 242
Ingersoll-Rand 331
Instruments Inc. T272
International Engrg. Inc. 132
International Nickel Co. Inc. 55

Jackson & Church Co. T324
Jefferson Chem. Co., Inc. 299
Jelliff Mfg. B318
Jenkins Bros. 77
Jerguson Gage & Valve Corp. M401
Johns-Manville 199

Kaiser Aluminum & Chemicals Inc. 376
Kalamazoo Tank & Silo Co. T318
Keasbey & Mattison Co. 390
Kemp Mfg. Co., C. H. 227
Kidde & Co., Walter 206
Kinney Mfg. Co. 304
Maurice A. Knight L400
Kold-Hold Mfg. Co. 277
Koppers Co. Inc. 296, 306
Koven & Bros. Inc., L. O. 196

LaBour Co. 372
Ladish Co. 35
Lapp Insulator Co. 46
Lawrence Mach. & Pump Corp. R395
Layne Bowler Co. L436
Link-Belt Co. 11, 57, 66
Liquid Carbonic Corp. 305
Liquidometer Corp. B320
Louisville Dryer Div. of Gen. Amer. Trans. Corp. 179
Lukens Steel Co. 61

Manning Maxwell & Moore Inc. 54
Marconi Inst. Ltd. B326
Master Elec. Co. ..... 3rd Cover
McGraw-Hill Book Co. R396
McLanahan & Stone Corp. 52
Mears-Kane-Ofeldt Inc. B324
Merrick Scale Mfg. Co. 405
Metalsmiths Div. of Orange Roller Bearing Co. Inc. 405
Metalweld Inc. 405
Michigan Pipe Co. R437
Michigan Wheel Co. LB399
Micro-Metallic Corp. 274
Mine Smelter Supply Co. B330
Minneapolis-Honeywell Regulator Co., Industrial Div. 72, 362–363
Mixing Equipment Co. Inc. 182
Monarch Mfg. Works Inc. 405
Monsanto Chemical Co. 74–75
Mt. Vernon Woodberry Mills Turner Halsey Co. 229
Morris Machine Works. L396

Nash Engrg. Co. 313
Natl. Airoil Burner Co. 194
National Aluminate Corp. 125
Natl. Carbon Div., Union Carbide & Carbon Corp. 269
Natl. Engrg. Co. 122–123
National Filtermedia Corp. 397
Natl. Lead Co. 333
Naugatuck Chemicals Div. of U. S. Rubber Co. 93
National Radiator Co. 292, L398
Neptune Meter Co. 399
Neptune Pump Mfg. Co. RB392
Niagara Alkali Co. 235
Niagara Filter Corp. 393
Nichols Engrg. & Research Corp. 295, 392
Nicholson & Co., W. B. T328
Nordstrom Valve Div., Rockwell Mfg. Co. 355
Norton Co. 323

Ohio Steel Foundry Co. 281
Oldbury Electro-Chem. Co. RB402
Oliver United Filters Inc. 385
Omega Machine Co. 341

Pabco Products Inc. 230
Patterson-Fdry & Mach. Co. ..... Fourth Cover
Patterson Kelley Co. 96
Penberthy Injector Co. 78
Pennsylvania Ind. Chemical Corp. 97
Perkins-Elmer Corp. 293
Permutit Co. 82–83
Pfaudler Co. 40–41
Pfizer & Co. Inc., Chas. 348
Philadelphia Gear Works Inc. 275
Phila. Quartz Co. T322
Pittsburgh Lectrodryer Corp. 81
Pittsburgh Lectromelt Corp. 321
Plastic Metals Div. of The National Radiator Co. L399
Potter Aeronautical Co. 221
Potts Horace T. Co. 346
Powell Co., Wm. 59, 258
Prater Pulverizer Co. 317
Pressed Steel Co. T356
Pritchard & Co., J. B. 317
Process Equip. Div. of Gen. Amer. Trans. Corp. 315
Protectoseal Co. 405

Quaker Oats Co. 88

Raybestos-Manhattan Inc. 383
Raymond Pulverizer Div., Combustion Engrg. Co. 214
Read Standard Corp. 256
Republic Steel Corp. 84
Research Corp. L335
Revere Copper & Brass Inc. 353
Ric-Wil Co. The. 257
Rietz Co. RT402
Rohm & Haas Co. 273
Roosevelt Oil & Refining Corp. 112
Roots-Connersville Blower Corp. 193
Ross Heater & Mfg. Co. 366
Ryerson & Son Inc., J. T. 134

Saran Lined Pipe Co. 243
Sarco, Inc. 191
Sauereisen Cements Co. 406
Schneible Co., Claude B. T320
Sealol Corp. R335
Shriver & Co. Inc. B284
Sieberling Latex Prods. Co. T328
Simpson Mix Muller Div., Natl. Engrg. Co. 122–123
Sier-Bath Gear & Pump Co. T282
Sinclair Research Laboratories Inc. 307
Sivyer Steel Casting Co. 26
W. W. Sly Mfg. Co. 205
A. O. Smith 249
Solvay Sales Div., Allied Chem. & Dye Corp. 242
Sparkler Mfg. Co. 357
Spray Engrg. Co. T326
Sprout Waldron & Co. 391
Standard Oil Co. Indiana. 116
Standard Steel Corp. LB397
Stanley Co. Inc., Wm. W. LT379
Stephens Adamson Mfg. Co. 379
Sterling Elec. Motors. 253
Stokes Machine Co., F. J. 54
Stone & Webster Engineering Corp. 69
Sturtevant Mills Co. 87
Submerged Combustion Co. B282
Surface Combustion Corp. 276
Sun Shipbuilding & Dry Dock Co. 76
Superior Combustion Ind. Inc. LB394
Sutton Steele & Steele Inc. 350
Swartwout Co. 186
Swenson Evaporator Co. 4–5
Syntron Co. R401

Taber Pump Co. RT404
Taylor Forge & Pipe Works 53
Taylor Instrument Co. 130–131
Texas Gulf Sulphur Co. Inc. 42
Timken Roller Bearing Co. 67
Toledo Scale Co. 247
Traylor Engrg. & Mfg. Co. 45
Tube Turns Inc. ..... 2nd Cover
Turner Halsey Co. Mt. Vernon Woodberry Mills. 229

Uehling Instrument Co. 427
Union Bag & Paper Corp. 10
Union Carbide & Carbon Corp. Carbinee & Carbon Chem. Co. 201, 269
Union Iron Works T284
Universal Road Machy. Co. RB394
U. S. Rubber Co. 73
U. S. Stoneware Co. 102

Virginia Smelting Co. 278

Wallace & Tiernan Co. Inc. R382
Walworth Co. 30
Watson Machine Co. T250
Watson Stillman 359
Westinghouse Elec. Corp. 43, 266–267, 370–371
Westinghouse Electric Corp. Sturtevant Div. 64
Wheeler Mfg. Co., C. H. 50
Whitlock Mfg. Co. 304
Whiton Machine Co. RT400
Wigins Gas Holder Div. of Gen. Amer. Transp. Corp. 217
Wilfley & Sons Inc., A. R. 351
Williams & Co. C. K. 252
Williams Patent Crusher & Pulverizer Co. 117
Wolverine Tube Div. of Calumet & Copper Co. 113
Worthington Pump & Machy. Corp. 8, 23, 27, 31, 34, 289
Wyandotte Chem. Corp. 47
Wyssmont Co. T340

Yale & Towne Mfg. Co. 89
Yarnell-Waring Co. 329
Youngstown Welding & Engineering Co. 309

FOR CLASSIFIED INDEX SEE PAGE 436

Chemical Engineering Reader Service

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EDITORIAL ITEMS

For more data, circle item number on postcard.

NEW PRODUCTS

	Page
Alkyd Resin	198D
Aluminosilicates	198C
Blowing Agent	197C
Cation Exchangers	196B
Coating Process	202H
Gasoline Additive	197A
Glass Cloth	202B
Lubricant	198B
Maleic Hydrazide	202D
Polyamide Resins	197B
Resin Cements	196A
Rust Preventative	200A
Synthetic Fiber	202A
Viscose Treatment	198E
Wood Product	198A

NEW EQUIPMENT

	Page
Atomic Battery	182C
Atomizing Nozzle	194B
Automatic Recorder	180D
Belt Splicing Method	184C
Belt Training Carrier	184E
Beta Gages	180I
Compressor Drive	182A
Continuous Ball Mill	178A
Control Unit	180F
Differential Pressure Unit	178E
Dust Hood	186E
Electric Heaters	188A
Electronic Scale	180C
Extrusion Machine	177B
Flare Burner	188D
Float-Operated Valve	178C
Fork Truck Device	184D
Heat Exchangers	188E
Heating Tape	188F
Hydraulic Test Stand	182D
Inhalator	186D
Iron Valves	194D
Liquid Filters	178B
Neoprene Hose	194A

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Advertisements

2	22	38	52f	73b	86	105	132e	195b	237	249	B273a	288–289	302	T322	L335	T356	372	390a	BR400
6–6a	23	39	52g	74–75a	87a	106–107	132d	199	229	T250	B272b	291	303	B322	R335	6356	373	390b	L401
6–6b	24–25	40–41	53	74–75b	87b	109	132e	200	230	B250	B272e	292	804	323	336	357	374	391	M401
6–6e	26	42	54	74–75c	87c	111	132f	201	231	251	B272d	293	305	T324	T338	358	375	T392	R401a
6–6d	27	43	56a	74–75d	87d	112	132g	202	233	253	273	294	306	B324	B338	360	376	BL392	R401b
6–6e	28–29a	44	56b	74–75e	87e	113	134	203	235a	253	274	295a	307	325	329	361	377	BR392	L402
6–6f	28–29b	45	57	74–75f	87f	114–115	175	204	235b	256	275	295b	308	T326	T340	362–363	378	393	TR403
6–6g	28–29c	46	58	74–75g	88	116	179	205	235c	257	276	295c	309	B326	B340	364a	379	T394	BR403
6	28–29d	47	59	74–75h	89	117a	181	206	235d	258a	277	295d	311	327	341	364b	380	BL394	TL403
7	28–29e	48–49	60	74–75i	90	117b	183a	207a	235e	258b	278a	295e	312	T328	344a	364c	381	BR394	BL403
8	30	50a	61	74–75j	91	117c	183b	207b	235f	258c	278b	296	315	B328	344b	364d	L382a	L395	L404
9	31a	50b	62	74–75k	92	118–119	183c	207c	235g	258d	278c	297a	317	329	344c	364e	L382b	R395	TR404
10	31b	51a	63	77	93	120	183d	207d	237	259	279	297b	T318	T330	344d	365a	R382	L396	BR404
11	31c	51b	64	78a	94–95	121	185	212	241	260	280	297c	B318	B330	344e	365b	383	LB397	405
12	31d	51c	65	78b	96	122–123	187	213	242	262	281	297d	319a	331	345	365c	384	R397	417
13	31e	51d	66	78c	97	124	189	214	243	263	T282	297e	319b	T332	346	365d	385	L396	L426
14	31f	51e	67	78d	98–101a	125	191	217	245	264	B282	297f	319c	B332	347	365e	386a	B396	M426
15	31g	51f	68	79	98–101b	126–127	192	218	T246	265	283	297g	319d	333	348	366	386b	TL399	TL427
16	31h	52a	69	80	98–101c	128–129	193a	219	B246	266–267	T284	299	319e	334a	350	367	386c	BL399	BL427
17	34	52b	70	81	98–101d	130–131	193b	221	247a	269	B284	300	T320	334b	351	368	387	R399	R427
18	35	52c	71	82–83	98–101e	132a	194	225	247b	271	285	301a	B320	334c	353	369	388	L400	439
19	36	52d	72	85	102	132b	196a	226	248	T272	287	301b	321	334d	356	370–371	389	TR420	440
20–21	37	52e	73a																

Editorial Items

176A	178D	180D	180J	184B	186C	188D	192B	194C	197B	198D	202C	204D	204I	206B	206G	208L	206B	206G	206L
177A	178E	180E	182A	184C	186D	188E	192A	194D	197C	198E	202D	204E	204J	206C	206H	208M	206C	206H	206M
177B	178F	180F	182B	184D	186E	188F	193B	196A	198A	200A	204A	204F	204K	206D	206I	208N	206D	206I	206N
178A	180A	180G	182C	184E	188A	190A	194A	196B	198B	202A	204B	204G	204L	206E	206J	208P	206E	206J	206P
178B	180B	180H	183D	184A	188B	190B	194B	197A	198C	202B	204C	204H	208A	206F	206K	208A	206F	206K	208Q
178C	180C	180I	184A	186B	189C	192A													

Card Expires February 15

Page

Oil Filters 177A
Packaged Compressor 194C
Pallet Loader 184B
Pipe Hanger 190B
Pipe Insulation 188C
Pneumatic Controller 178D
Pocket Thermometer 180H
Portable Foam Tower 186A
Potentiometer Circuit 180G
Pressure Filters 176A
Process Pump 190A
Reducer Fitting 192B
Respirator 186C
Rotary Pump 192D
Scanning System 178F
Servomechanism Unit 180J
Sludge Feeder 184A
Spray Cooler 188D
Synchronous Motor 182B
Telemetering Equipment 180E
Triplex Pump 192A
Valve Seal 192A
Vibrating Unit 186B
Viscosity Meter 180A
Viscosity Meter 180B

NEW TECHNICAL LITERATURE

Air Conditioning 206E
Aluminum Drums 204G
Caustic Soda 205E
Compressed Gases 205F
Copper Corrosion 205H
Crushers 204C
Drum Cleaning 206C
Dust Control 204L
Filters 205C
Heater 205A
Instruments 204J
Instruments 205N
Instruments 206A
Instruments 206F
Instruments 206L
Instruments 206P
Lignum-Vitae 205P
Materials Handling 204A
Materials Handling 206M
Metal Hose 206H
Mixers 206D

Page

Molding Powders 205J
Motors 206N
Nitrosyl Chloride 205K
Packings 204B
Piping 204F
Polyethylene 206J
Process Equipment 205D
Process Equipment 206G
Pumps 205M
Radioactivity 206T
Refractory Coating 204D
Refrigerant 206Q
Salt 205G
Separators 204E
Steam Generators 204H
Steam Traps 205I
Tantalum Equipment 204T
Thermocouple Wells 206H
Urea 204H
Valves 206K
Waste Treatment 205B
Welding 205L

PRODUCTS ADVERTISED

For more data, circle item number on postcard.

Page

Accumulators
Hydropneumatic, data sheet 29 ... 297f
Weight-Loaded, data sheet 29A ... 297g
Air Cleaning equipment, precipitrons ... 64
Autoclaves ... B328
Belts
Conveyor ... 73b
V, grommet ... 13
Blowers
Centrifugal ... 193a
Rotary positive ... 193b
Boilers, steam ... 189, B324
Burns, gas, direct fired ... B282
Car shakers ... 65
Casters & wheels ... L395
Castings
Centrifugal, catalog 3150 ... 321
Stainless steel ... 281
Steel ... 26

Page

Catalyst supports ... 323
Catalysts, platinum ... 7
Centrifugals
Centrol control ... TL437
Centrifuging, separating ... 260
Chain, roller steel ... 37
Chemical processes, refinery sludge recovery ... 74-75c
Chemicals
Activated carbon, G-60 ... 248
Adsorbents, bauxit—based ... L382b
Aluminum chlorid ... 51d
Antimony trichloride ... 52f
Basic ... 227
Beta-phenylethylamine ... 74-75j
Carbon dioxide ... 205
Carbonate of potash ... 235c
Catalysts
Fluid cracking aerocat ... 28-29d
Hydrogenation ... 44
Caustic potash ... 235b
Caustic soda ... 51a, 235e
Chlorine ... 51b
Chlorine, liquid ... 235a
Citric acid, anhydrous ... 348
DDT ... 74-75k
Detergents, synthetic Kreelon ... 47
Dicyclohexylamine ... 74-75m
Ethylene glycol ... 299
Fatty acids, coconut ... 121
Fluorine compounds ... 111
Formaldehyde ... 18
Fullers earth ... L382a
General line ... BR402
Metallic oxide pigments ... 252
3-Methyl-1-phenyl-5-pyrazolone ... 60
Muriatic acid ... 51c
Nonyl phenol ... 206
Ortho-benzyl-para-chlorophenol santophen #1, bulletin 9-51 ... 74-75j
Oxygenated solvents & chemicals ... 71
Paradichlorobenzene ... 235d
Phenol ... 288-289
Phenylacetamide ... 74-75e
Phenylacetic acid ... 74-75b
Phenylacetonitrile ... 74-75c
Phthalic anhydride ... 70
Polyesters, Vibrin ... 92

Page

Abbe Engineering Co. ... 294
Allis-Chalmers Mfg. Co. ... 1
Alsop Engineering Corp. ... 294
American Air Filter Co., Inc. ... 64
American Blower Corp. ... 193a
American Brass Co. ... 193b
American Chain & Cable Co., Inc., Page Steel & Wire Div. ... 37
American Chemical Paint Co. ... 294
American Cyanamid Co., Calco Chemical Div. ... 60
American Cyanamid Co., Industrial Chemicals Div. ... 51a, 235e
American Engineering Co. ... 294
American Felt Co. ... 294
American Flexible Coupling Co. ... 294
American Foundry Equipment Co. ... 294
American Hard Rubber Co. ... 294
American Instrument Co. ... 180A
American Locomotive Co. ... 294
American Machine & Metals, Inc., East Pittsburgh Div. ... 294
American Manganese Steel Div. ... 294
American Monorail Co. ... 294
American Pulverizer Co. ... 294
American Radiator & Standard Sanitary Corp. ... 294
American Schaeffer & Budenberg Corp. ... 294
American Steel & Wire Co. ... 294
American Tar Products Co. ... 294
American Thermometer Co. ... 294
American Wheelabrator & Equipment Corp. ... 294
Amsco Steel Co. ... 294
Anaconda Wire & Cable Co. ... 294
Anchor Packing Co. ... 294
Armco Drainage & Metal Products, Inc. ... 294
Armstrong Cork Co. ... 294
Armstrong Machine Works ... 294
Ashcroft Gauges, Div. of Manning, Maxwell & Moore, Inc. ... 294
Atlas Mineral Products Co. ... 294
Atlas Powder Co. ... 248
Autoclave Engineers, Inc. ... 294
Automatic Electric Sales Corp. ... 294
Automatic Temperature Control Co., Inc. ... 294
Autovalve Co. ... 294
Aviation Corp., Fairchild Engine & Airplane Div. ... 294
Babcock & Wilcox Co. ... 294
Bacharach Industrial Instrument Co. ... 294
Bailey Meter Co. ... 294
Baker Perkins, Inc. ... 294
Barber-Colman Co. ... 294
Barco Manufacturing Co. ... 294
Barnebey-Cheney Co. ... 294
Barrett Co. ... 294
Bart Manufacturing Co. ... 294
Bauer Bros. Co. ... 294
Bell & Gossett Co. ... 294
Bethlehem Steel Co. ... 294
Bird Machine Co. ... 294
Blaw-Knox Const. Co. 241, 294
Boston Woven Hose & Rubber Co. ... 364
Bridgeport Brass Co. ... 22
Bristol Company ... 373
Brookfield Engrg. Labs. Inc. ... LT399
Brown & Root, Inc. ... 218
Buell Engrg. Co. ... 369
Buffalo Forge Co. ... 16
Buffalo Meter Co. ... 404
Buffovak Equipt. Div. Blaw-Knox ... 263
Builders-Providence Inc. ... RT402
Burgess-Manning ... 36

Cambridge Wire Cloth Co. ... 266
Camco Products Inc. ... 262
Carbide & Carbon Chemical Co., Div. Union Carbide & Carbon Corp. ... 201
The Carburundum Co. ... 48-49
Carpenter Steel Co. ... 251
Carrier Corp. ... 380
Cash Co., A. W. ... 207
A. W. Cash Valve Mfg. Corp. ... RB404
Celanese Corp. of America ... 18
Century Electric Co. ... 84
Chapman Valve Mfg. Co. ... 90
Chemical Construction ... 384
Chem. Steel Const. Co. ... 405
Chicago Bridge & Iron Co. ... 14
Chicago Eye Shield Co. ... L402
Chicago Pneumatic Tool Co. ... 385
Childers Mfg. Co. ... 20-21
Cleaver-Brooks Co. ... 189
Cleveland Worm & Gear Co. ... 109
Combustion Engrg. Superheaters, Inc. ... 32-33
Consolidated Chemical Industries ... 378
Corning Glass Works ... 91
Crane Co. ... 212
Crouse-Hinds Co. ... 126-129
Crucible Steel of America ... 225
Cuno Engrg. Corp. ... 361

Dampney Co., The ... R403
Darco Dept. Atlas Powder Co. ... 248
Darnell Corp. Ltd. ... L395
Davison Chemical Corp., The ... 44
Day Co., The ... 256
DeLaval Separator ... 260
DeLaval Steam Turbine Co. ... 381

Page

Dietrich Industries of 100 ... 294
Black, Sivalls & Bryson Inc. ... 236
Blaw Knox Const. Co. 241, 294
Boston Woven Hose & Rubber Co. ... 364
Bridgeport Brass Co. ... 22
Bristol Company ... 373
Brookfield Engrg. Labs. Inc. ... LT399
Brown & Root, Inc. ... 218
Buell Engrg. Co. ... 369
Buffalo Forge Co. ... 16
Buffalo Meter Co. ... 404
Buffovak Equipt. Div. Blaw-Knox ... 263
Builders-Providence Inc. ... RT402
Burgess-Manning ... 36

Cambridge Wire Cloth Co. ... 266
Camco Products Inc. ... 262
Carbide & Carbon Chemical Co., Div. Union Carbide & Carbon Corp. ... 201
The Carburundum Co. ... 48-49
Carpenter Steel Co. ... 251
Carrier Corp. ... 380
Cash Co., A. W. ... 207
A. W. Cash Valve Mfg. Corp. ... RB404
Celanese Corp. of America ... 18
Century Electric Co. ... 84
Chapman Valve Mfg. Co. ... 90
Chemical Construction ... 384
Chem. Steel Const. Co. ... 405
Chicago Bridge & Iron Co. ... 14
Chicago Eye Shield Co. ... L402
Chicago Pneumatic Tool Co. ... 385
Childers Mfg. Co. ... 20-21
Cleaver-Brooks Co. ... 189
Cleveland Worm & Gear Co. ... 109
Combustion Engrg. Superheaters, Inc. ... 32-33
Consolidated Chemical Industries ... 378
Corning Glass Works ... 91
Crane Co. ... 212
Crouse-Hinds Co. ... 126-129
Crucible Steel of America ... 225
Cuno Engrg. Corp. ... 361

Dampney Co., The ... R403
Darco Dept. Atlas Powder Co. ... 248
Darnell Corp. Ltd. ... L395
Davison Chemical Corp., The ... 44
Day Co., The ... 256
DeLaval Separator ... 260
DeLaval Steam Turbine Co. ... 381

Page

Corp. ... 179, 217, 315
Gen. Chem. Div. Allied Chem. & Dye Corp. ... 111
General Electric Co. ... 106-107 126-127, 245, 319, 365
General Ind. Development Corp. ... R398
General Radio Co. ... 62
Gerrard & Co. ... LB403
Globe Steel Tubes Co. ... 19
The B. F. Goodrich Co. ... 12
Goodyear Tire & Rubber ... 17
Gould Pumps Inc. ... 301
Graver Water Conditioning Co. ... 58
Greer Hydraulics Inc. ... 291
Gunthard Co., A. ... 374

Hagan Corp. ... 239
Hammond Bag & Paper ... T246
Harbison-Walker Refractories Co. ... 40
Hanovia Chemical & Mfg. Co. ... 192
Hardinge Co., The ... 244
H. M. Harper Co. ... B322
Harrisburg Steel Corp. ... L401
Heisken, W. P. ... 405
Helicoid Gage Div., Amer. Chain & Cable Co. ... 226
Hennsey Co. ... T232
Hercules Powder Co. ... 302
Homestead Valve Mfg. Co. 311
Hooker Electrochemical Co. 51
Hough Co., Frank ... 367

Illinois Water Treatment Co. ... 302
Ingalls Iron Works Co. ... 242
Ingersoll-Rand ... 231
Instruments Inc. ... T272
International Engrg. Inc. ... 132
International Nickel Co. Inc. ... 55

Jackson & Church Co. ... T324
Jefferson Chem. Co., Inc. ... 299
Jelliff Mfg. ... B318
Jenkins Bros. ... 77
Jerguson Gage & Valve Corp. ... M401
Johns-Manville ... 199

Kaiser Aluminum & Chemicals Inc. ... 376
Kalamazoo Tank & Silo Co. ... T318
Keasbey & Mattison Co. ... 250
Kemp Mfg. Co., C. H. ... 227
Kidde & Co., Walter ... 200
Kinney Mfg. Co. ... 304
Maurice A. Knight ... L400
Kold-Hold Mfg. Co. ... 277
Koppers Co. Inc. ... 296, 306
Koven & Bros. Inc., L. O. ... 195

Page

National Filtermedia Corp. 397
Natl. Lead Co. ... 333
Naugatuck Chemicals Div. of U. S. Rubber Co. ... 93
National Radiator Co. ... 292, L398
Neptune Meter Co. ... 399
Neptune Pump Mfg. Co. RB392
Niagara Alkali Co. ... 235
Niagara Filter Corp. ... 393
Nichols Engrg. & Research Corp. ... 395, 397
Nicholson & Co., W. B. ... T338
Nordstrom Valve Div., Rockwell Mfg. Co. ... 255
Norton Co. ... 323

Ohio Steel Foundry Co. ... 281
Oldbury Electro-Chem. Co. ... RB402
Oliver United Filters Inc. 385
Omega Machine Co. ... 341

Pabco Products Inc. ... 230
Patterson-Fdry & Mach. Co. ... Fourth Cover
Patterson Kelley Co. ... 96
Penberthy Injector Co. ... 78
Pennsylvania Ind. Chemical Corp. ... 97
Perkins-Elmer Corp. ... 293
Permutit Co. ... 82-83
Pfaudler Co. ... 40-41
Pfizer & Co. Inc., Chas. ... 348
Philadelphia Gear Works Inc. ... 275
Phila. Quartz Co. ... T222
Pittsburgh Lectromelt Corp. 221
Plastic Metals Div. of The National Radiator Co. ... L398
Potter Aeronautical Co. ... 221
Potts Horace T. Co. ... 396
Powell Co., Wm. ... 52, 258
Prater Pulverizer Co. ... 317
Pressed Steel Co. ... T256
Pritchard & Co., J. B. ... 317
Process Equip. Div. of Gen. Amer. Transp. Corp. ... 315
Protectoseal Co. ... 405

Quaker Oats Co. ... 88

Raybestos-Manhattan Inc. 383
Raymond Pulverizer Div., Combustion Engrg. Co. ... 314
Read Standard Corp. ... 256
Republic Steel Corp. ... 34
Research Corp. ... L335
Revere Copper & Brass Inc. ... 353
Ric-Wil Co. The ... 257
Riets Co. ... RT403
Rohm & Haas Co. ... 373

Page

Sutton Steele & Steele Inc. 350
Swartwout Co. ... 186
Swenson Evaporator Co. ... 4-5
Syntron Co. ... R401

Taber Pump Co. ... RT404
Taylor Forge & Pipe Works 53
Taylor Instrument Co. 130-131
Texas Gulf Sulphur Co. Inc. 42
Timken Roller Bearing Co. 67
Toledo Scale Co. ... 247
Traylor Engrg. & Mfg. Co. 45
Tube Turns Inc. ... 2nd Cover
Turner Halsey Co. Mt. Vernon Woodberry Mills. 229

Uehling Instrument Co. ... 437
Union Bag & Paper Corp. ... 10
Union Carbide & Carbon Corp. Carbine & Carbon Chem. Co. ... 201, 269
Union Iron Works ... T284
Universal Road Machy. Co. ... RB394
U. S. Rubber Co. ... 78
U. S. Stoneware Co. ... 102

Virginia Smelting Co. ... 278

Wallace & Tiernan Co. Inc. ... R382
Walworth Co. ... 30
Watson Machine Co. ... T250
Watson Stillman Co. ... 359
Westinghouse Elec. Corp. ... 43, 266-267, 370-371
Westinghouse Electric Corp. Sturtevant Div. ... 64
Wheeler Mfg. Co., C. H. ... 50
Whitlock Mfg. Co. ... 204
Whiton Machine Co. ... RT400
Wiggins Gas Holder Div. of Gen. Amer. Transp. Corp. 217
Wilfley & Sons Inc., A. R. ... 351
Williams & Co. C. K. ... 252
Williams Patent Crusher & Pulverizer Co. ... 117
Wolverine Tube Div. of Calumet & Copper Co. 113
Worthington Pump & Machy. Corp. ... 8, 22, 27, 31, 34, 259
Wyandotte Chem. Corp. ... 47
Wyssmont Co. ... T340

Yale & Towne Mfg. Co. ... 89
Yarnell-Waring Co. ... 329
Youngstown Welding & Engineering Co. ... 308

FOR CLASSIFIED INDEX SEE PAGE 436

Page

Polyethylene glycols 201
Potassium phenylacetate 74-75f
QO-Furfural 88
Refrigerants, activated alumina 37
Resin finish, Supersect 28-29b
Resin, laminac 28-29c
Resins, piccoumaron 97
Silicates, soluble T222
Sodium hydrosulphite 278a
Solvents, aliphatic naptha 112
Sorbitol 346
Sulfur chlorides 51f
Sulfur dioxide, liquid 278a
Sulphuric acid, spent, used to produce new product 278
Surface active agents 28-29a
Tetrachloro phthalic anhydride 235g
Trichlorethylene 235f
Versenes, bulletin 2 368
Viscosity index improver, Santodex bulletin 9-48 ..... 74-75d
Vitamin B 12 ..... 28-29e
Zinc hydrosulphite 278b
Classifiers 295c
Closures, drum, tri-sure 312
Clutches, friction, rolling grip 389
Coatings
  Protective
    Amerseal 237
    Corrosion-resistant B272d
    Paints, rubber-base 262
    Phoscote process for steel structures 14
Coils, heat, plate 277
Combustion units, tandem, oil-gas 194
Compressors
  Gas 34
  Oil-less cylinder, bulletin 728-S 288
Concentrators, high temperature 284
Condensing & cooling sections, manual HT-20 292
Connectors, flexible metal 234a
Containers, bags, multiwall 19, T246
Containers, drums, aluminum 376
Conveyors
  Belt 66
  Bulk-Flo, book 2175 11
  Chemical, closed-circuit 379
  Pneumatic 265

Page

  Pneumatic dry chemical 287
Coolers, grate, bulletin 07B6368A 12
Crystallizers, vacuum 4-5g
Cylinders, gas, high pressure seamless steel L401
Den & excavator 87e
Disintegration equipment
  Ball mills 132f
  Ball mills, continuous conical 132e
  Crushers 52a
  Disintegrators TL402
  Hammermills, heavy duty 117a
  Hammermills, helix-seal 117b
  Mills
    Bulletin 173 92
  Pulverizers, rotary 87b
  Ring roll mill 87a
  Roller mills with air separation 117c
  Vertical mills 214
Door, quick opening T294
Dryers
  Air, gas or liquid, bulletin D-27 227
  Bulletin 508 ..... BL397
  Rotary 179
  Spray 4-5e, T292
  Spray, portable 295c
  Turbo, for heat sensitive & fragile materials T240
  Vacuum rotary, bulletin 241 263
  With activated alumina 81
Dust collectors L335
Dust collectors, multi-wash T230
Dust control, bulletin 98 295
Dust recovery systems 369
Ejectors
  Jet pump, bulletin 512 ..... 78c
  Steam jet 50a
  Steam-jet, bulletin 9612A 331
  Steam-jet, corrosion-proof 8
Engineering & construction
  Hydrocarbon extraction plants 69
  Natural gas, dehydration plants 241
  Plant construction & modernization, safety factor M436
  Plants and equipment R398
  Plants, in Southwest 218
  Sulphur recovery plants 317
Evaporators
  Cast lead 4-5d

Page

  Flat plate, with channel switching system 315
  Forced circulation 4-5c
  Quintuple effect 4-5a
  Single-effect 62
Fabricators
  Impregnators 187
  Lead-lined equipment, homogeneous 374
  Pressure vessels 260
  Process equipment 118-119
  Shell & tube equipment B246
  Tanks & condenser, steel 195b
  Tank, steel, horizontal 195a
  Tanks, storage 242
  Tubing assemblies T256
  Wire-mesh products B318
Fans, axial flow, bulletin 3533-C 16
Fastenings, non-corrosive B322
Feeders
  Batch weighing R401b
  Chemical, solution, dry materials, for controlled blending systems 341
  Constant-weight 344a
  Disc 344c
  Gravimetric R401a
  Reciprocating 52b
  Rotary airlock B328
  Volumetric, non-flooding 344d
  Weigh R382
  Weight-recording 344b
Filter aids, celite 189
Filter media
  Acrylic fiber, orlon 287
  Cotton & synthetic fabrics B3400
  Fabrics 229
Filters
  Centrifugal, continuous 9
  Chemical, continuous vacuum 385
  Dust, bulletin 491 280
  Element coverings R397
  Guide book B284
  High solids capacity, bulletin, H-1051 392
  Horizontal plate 257
  Stainless steel, porous 274
  String, bulletin 103 120
  Vacuum, rotary drum 4-5b
Fittings & fasteners, stainless steel, catalog A B356

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Circle desired item, fill in reverse side, tear out and mail

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Advertisements

2	22	38	52f	75b	86	105	132e	195b	227	249	B272a	288-289	302	T322	L335	T356	372	390a	BR459
4-5a	23	39	52g	74-75a	87a	106-107	132d	199	229	T250	B272b	291	303	B322	R335	B356	373	390b	L403
4-5b	24-25	40-41	53	74-75b	87b	109	132e	200	230	B250	B272e	292	304	323	336	357	374	291	M481
4-5e	26	42	54	74-75c	87c	111	132f	201	231	251	B272d	293	305	T324	T336	359	375	T392	R401a
4-5d	27	43	55a	74-75d	87d	112	132g	202	233	252	273	294	306	B324	B336	360	376	BL392	R401b
4-5e	28-29a	44	55b	74-75e	87e	113	134	203	235a	253	274	295a	307	325	339	361	377	BR392	L402
4-5f	28-29b	45	57	74-75f	87f	114-115	175	204	235b	256	275	295b	308	T326	T340	362-363	378	393	TR402
4-5g	28-29c	46	58	74-75g	88	116	179	205	235c	257	276	295c	309	B326	B340	364a	379	T394	BR402
6	28-29d	47	59	74-75h	89	117a	181	206	235d	258a	277	295d	311	327	341	364b	380	BL394	TL403
7	28-29e	48-49	60	74-75i	90	177b	183a	207a	235e	258b	278a	295e	312	T328	344a	364c	381	BR394	BL403
8	30	50a	61	74-75j	91	177c	183b	207b	235f	258c	278b	298	315	B328	344b	364d	L382a	L395	L404
9	31a	50b	62	74-75k	92	118-119	183c	207c	235g	258d	278c	297a	317	329	344c	364e	L382b	R395	TR404
10	31b	51a	63	77	93	120	183d	207d	237	259	279	297b	T318	T330	344d	365a	R382	L396	BR404
11	31c	51b	64	78a	94-95	121	185	213	241	260	280	297c	B318	B330	344e	365b	383	L3397	405
12	31d	51c	65	78b	96	122-123	187	213	242	262	281	297d	319a	331	345	365c	384	R397	417
13	31e	51d	66	78c	97	124	189	214	243	263	T282	297e	319b	T332	346	365d	385	L398	L438
14	31f	51e	67	78d	98-101a	126	191	217	245	264	B282	297f	319c	B332	347	365e	386a	R398	M436
15	31g	51f	68	79	98-101b	126-127	193	218	T246	265	283	297g	319d	333	348	366	386b	TL399	TL437
16	31h	52a	69	80	98-101c	128-129	193a	219	B246	266-267	T284	299	319e	334a	350	367	386c	BL399	BL437
17	34	52b	70	81	98-101d	130-131	193b	221	247a	269	B284	300	T320	334b	351	368	387	R399	R437
18	35	52c	71	82-83	98-101e	132a	194	225	247b	271	285	301a	B320	334c	353	369	388	L400	439
19-21	36	52d	72	85	102	132b	195a	226	248	T272	287	301b	321	334d	355	370-371	389	TR400	440
	37	52e	73a																

Editorial Items

176A	178D	180D	180J	184B	186C	188D	192B	194C	197B	198D	203C	204D	204I	205B	206G	208L	206B	208G	206L
177A	178E	180E	182A	184C	186D	188E	193A	194D	197C	198E	203D	204E	204J	205C	205H	208M	206C	206H	206M
177B	178F	180F	182B	184D	186E	188F	193B	195A	198A	200A	204A	204F	204K	205D	205I	206N	206D	206I	206N
178A	180A	180G	182C	184E	188A	190A	194A	198B	198B	202A	204B	204G	204L	205E	205J	206P	206E	206J	206P
178B	180B	180H	183D	186A	188B	190B	194B	197A	198C	202B	204C	204H	205A	205F	206K	206A	206F	206K	206Q
178C	180C	180I	184A	186B	188C	192A													

Card Expires February 15

Page

Fittings
Connectors, aligning 386c
Flanges, insert 386a
Forged, carbon, alloy & stainless steel 359
General lines 35
Joints
Ball, bulletin 125 245
Circular 84 50
Outlets, pressure vessel, catalog 513-1251 53
Stainless steel 262
Unions, tube 386b
Welding 2, 19
Fire extinguishing equipment 266
Fire extinguishing systems, fire-fog 264
Floors, corrosion-resistant B272b
Furnaces
Multiple hearth 295a
Oxide reduction 221
Gas for flame control in making fiberglas 285
Gasholders, bulletin WG-22 217
Gaskets, spiral-wound 212
Generators
Steam, catalog 322 ..... BL394
Steam turbine 27
Heat exchangers, type CP, bulletin 2.1K3 366
Heating systems, downthermo 247
Herreshoffing units, 18 inch 295b
Hose
Air
Aurochs 364c
Bay state drill 364b
Concord 364a
Vari-purpose 364e
Vim 364d
Flexible metal 334b
Ortac 17
Humidity conditioning 276
Instruments
Analyzers, infrared plants-stream 219
Batch mixing meters B295
Control systems, electronic 185
Controllers
Fulscope, bulletin 98151 120-121
Series 500, bulletin A120 273

Page

Dew point recorder, bulletin GEC-588 ..... 365e
Diffraction, electron bulletin GEC-656 ..... 365d
Feed water meters T332
Flowmeters, electronic 231
Sound feeder control 344e
Spectrometers
Infrared 292
Mass, bulletin GEC-587 ..... 365b
Temperature indicators, bulletin GEC-218B 219e
Temperature responsive resistors B250
Thermocouples, accessories, bulletin GEC-714 ..... 219d
Thermocouple potentiometer, bulletin GEC-245 ..... 219e
Thermometers, resistance, with bulb bulletin GEC-835 ..... 219a
Thermostats, multi-purpose 39
Viscometers TL399
Insulations
Cork coverings 68
Heat, 85% magnesia 220, 290a
Jacketing aluminum, weather-proof 20-21
Kilns, rotary, bulletin 6121 45
Laboratory ware, platinum 282
Lamps, mercury arc 192
Linings
Corrosion-resistant B272c
Pipe, wood R427
Rubber 283
Rubber, tanks 283
Lubricants 116
Machinery design service 61
Magnets, perma-plate, catalog C-1205A 275
Materials of construction
Cement, corrosion-resistant B272a
Glass, for alkali-resisting linings 401
Glazed tile T285
Hard rubber equipment 181
Nickel alloys for doctor blades 55
Permanite L400
Stainless steel 225
Stainless steel No. 20 251
Stainless steel, straight-chrome 134
Technical advisory service 353

Page

Tygon, for linings, tubing & paints 102
Materials handling equipment 291
Metal powders, for catalysts and chemical agents L398
Mixing equipment
Agitators, top entering 185d
Blenders
Conical, with gyro-centric screens 440
Dry 132c
Twin shell 96
Vertical, batch 391
Mixers
Chemical 31a
Composition materials 31c
Drugs & Plastics 31b
Dry batch 87c
Enamel frits 31d
Fertilizers 31g
Furnace charges 31h
Furnace charges & glass batches 31e
Muller type 122-123
Portable 132a, 183b
Ribbon 132d
Side entering 132b, 183c
Soap powder 31f
16 Speed 183a
Mixing, masticating, plasticizing & compounding T250
Propellers, vibrationless BL399
Force measurement, pneumatic 339
Gages
Liquid level, bulletin 35 ..... 78a
Liquid level, remote reading M491
Pressure 226
Tank B320
High-voltage control, bulletin GEA-5409A 245
Humidity measurement and control 85
Liquid measuring meters, stainless steel L404
Liquid measuring meters, tank, bulletin 945 ..... LB437
Measuring, test, bulletin GEC-1616 ..... 365e
Moisture meters B326
Photometers, X-Ray bulletin GEC-412A 365a
Pyrometer, type HP-3 bulletin GEC-713 ..... 319b

Birmingham Committee of 100 294
Black, Sivalls & Bryson Inc. 276
Blaw Knox Const. Co. 241, 294
Boston Woven Hose & Rubber Co. 364
Bridgeport Brass Co. 22
Bristol Company 272
Brookfield Engrg. Labs. Inc. LT299
Brown & Root Inc. 218
Buell Engrg. Co. 369
Buffalo Forge Co. 16
Buffalo Meter Co. 404
Buflovak Equipt. Div. Blaw-Knox 262
Builders-Providence Inc. RT402
Burgess-Manning 36

Cambridge Wire Cloth Co. ..206
Cameo Products Inc. 262
Carbide & Carbon Chemical Co., Div. Union Carbide & Carbon Corp. 201
The Carburundum Co. ...48-49
Carpenter Steel Co. 251
Carrier Corp. 280
Cash Co., A. W. 207
A. W. Cash Valve Mfg. Corp. RB404
Celanese Corp. of America. 18
Century Electric Co. 86
Chapman Valve Mfg. Co. ... 90
Chemical Construction 384
Chem. Steel Constr. Co. 405
Chicago Bridge & Iron Co. 14
Chicago Eye Shield Co. ...L402
Chicago Pneumatic Tool Co. 385
Childers Mfg. Co. 20-21
Cleaver-Brooks Co. 189
Cleveland Worm & Gear Co. 109
Combustion Engrg. Superheaters, Inc. 32-33
Consolidated Chemical Industries 378
Corning Glass Works 91
Crane Co. 212
Crouse-Hinds Co. 128-129
Crucible Steel of America. 225
Cuno Engrg. Corp. 361

Dampney Co., The. R402
Darco Dept. Atlas Powder Co. 248
Darnell Corp. Ltd. L395
Davison Chemical Corp., The 44
Day Co., The 280
DeLaval Separator 260
DeLaval Steam Turb. Co. 231
Corp. 179, 217, 315
Gen. Chem. Div. Allied Chem. & Dye Corp. 111
General Electric Co. ..106-107 126-127, 245, 319, 365
General Ind. Development Corp. B338
General Radio Co. 42
Gerrard & Co. LB402
Globe Steel Tubes Co. 19
The B. F. Goodrich Co. 12
Goodyear Tire & Rubber. 17
Goulds Pumps Inc. 301
Graver Water Conditioning Co. 58
Greer Hydraulics Inc. 291
Gunthard Co., A. 374

Hagan Corp. 239
Hammond Bag & Paper. .T246
Harbison-Walker Refractories Co. 80
Hanovia Chemical & Mfg. Co. 192
Hardinge Co., The 244
H. M. Harper Co. B322
Harrisburg Steel Corp. ...L402
Heinicken, W. F. 405
Helicoid Gage Div., Amer. Chain & Cable Co. 226
Hensley Co. T332
Hercules Powder Co. 302
Homestead Valve Mfg. Co. 311
Hooker Electrochemical Co. 51
Hough Co., Frank 367

Illinois Water Treatment Co. 303
Ingalls Iron Works Co. 242
Ingersoll-Rand 231
Instruments Inc. T272
International Engrg. Inc. .132
International Nickel Co. Inc. 55

Jackson & Church Co. T324
Jefferson Chem. Co., Inc. .299
Jelliff Mfg. B318
Jenkins Bros. 77
Jerguson Gage & Valve Corp. M401
Johns-Manville 199

Kaiser Aluminum & Chemicals Inc. 276
Kalamazoo Tank & Silo Co. T318
Keasbey & Mattison Co. 290
Kemp Mfg. Co., C. H. 227
Kidde & Co., Walter 200
Kinney Mfg. Co. 304
Maurice A. Knight L400
Kold-Hold Mfg. Co. 277
Koppers Co. Inc. 296, 306
Koven & Bros. Inc., L. O. .195

National Filtermedia Corp. 397
Natl. Lead Co. 233
Naugatuck Chemicals Div. of U. S. Rubber Co. 93
National Radiator Co. 292, L398
Neptune Meter Co. 399
Neptune Pump Mfg. Co. ..B392
Niagara Alkali Co. 235
Niagara Filter Corp. 393
Nichols Engrg. & Research Corp. 295, 392
Nicholson & Co., W. B. ..T338
Nordstrom Valve Div., Rockwell Mfg. Co. 355
Norton Co. 323

Ohio Steel Foundry Co. 281
Oldbury Electro-Chem. Co. RB402
Oliver United Filters Inc. .285
Omega Machine Co. 341

Pabco Products Inc. 230
Patterson-Fdry & Mach. Co. ..... Fourth Cover
Patterson-Kelley Co. 96
Penberthy Injector Co. 78
Pennsylvania Ind. Chemical Corp. 97
Perkins-Elmer Corp. 292
Permutit Co. 82-83
Pfaudler Co. 40-41
Pfizer & Co. Inc., Chas. 348
Philadelphia Gear Works Inc. 275
Phila. Quartz Co. T322
Pittsburgh Lectrodryer Corp. 81
Pittsburgh Lectromelt Corp. 221
Plastic Metals Div. of The National Radiator Co. .L399
Porter Aeronautical Co. 321
Potts Horace T. Co. 386
Powell Co., Wm. 59, 258
Prater Pulverizer Co. 317
Pressed Steel Co. T256
Pritchard & Co., J. B. 317
Process Equip. Div. of Gen. Amer. Trans. Corp. 315
Protectoseal Co. 405

Quaker Oats Co. 93

Raybestos-Manhattan Inc. .383
Raymond Pulverizer Div., Combustion Engrg. Co. ...214
Read Standard Corp. 256
Republic Steel Corp. 84
Research Corp. L335
Revere Copper & Brass Inc. 253
Ric-Wil Co. The. 257
Rietz Co. RT403
Rohm & Haas Co. 273

Sutton Steele & Steele Inc. 256
Swartwout Co. 185
Swenson Evaporator Co. ...4-5
Syntron Co. R401

Taber Pump Co. RT404
Taylor Forge & Pipe Works 53
Taylor Instrument Co. .130-131
Texas Gulf Sulphur Co. Inc. 42
Timken Roller Bearing Co. 67
Toledo Scale Co. 247
Traylor Engrg. & Mfg. Co. 45
Tube Turns Inc. .....2nd Cover
Turner Halsey Co. Mt. Vernon Woodberry Mills. 229

Uehling Instrument Co. 427
Union Bag & Paper Corp. . 10
Union Carbide & Carbon Corp. Carbine & Carbon Chem. Co. 201, 269
Union Iron Works. T254
Universal Road Machy. Co. RB394
U. S. Rubber Co. 72
U. S. Stoneware Co. 102

Virginia Smelting Co. 278

Wallace & Tiernan Co. Inc. R382
Walworth Co. 30
Watson Machine Co. T250
Watson Stillman 359
Westinghouse Elec. Corp. 42, 266-267, 270-271
Westinghouse Electric Corp. Sturtevant Div. 64
Wheeler Mfg. Co., C. H. ... 50
Whitlock Mfg. Co. 204
Whitton Machine Co. RT400
Wiggins Gas Holder Div. of Gen. Amer. Transp. Corp. 217
Wilfley & Sons Inc., A. R. .351
Williams & Co. C. K. 252
Williams Patent Crusher & Pulverizer Co. 117
Wolverine Tube Div. of Calument & Copper Co. .113
Worthington Pump & Machy. Corp. ...8, 23, 27, 31, 34, 289
Wyandotte Chem. Corp. 47
Wyssmont Co. T340

Yale & Towne Mfg. Co. 89
Yarnell-Waring Co. 329
Youngstown Welding & Engineering Co. 308

FOR CLASSIFIED INDEX SEE PAGE 426

Page

Recorder-controller, bulletin 230-C..377
Recorders, 5-milliampere 62
Recording-controlling system...362-363
Recording, indication, controlling..TR402
Relays, mercury BL392
Motor starters 300
Motors
Chemical, life-line 266-267
Drip-proof 98-101e
Enclosed, fan-cooled, bulletin 51B7228 175
Explosion-proof 79
Gear 439
Splash proof 86
Synchronous, low-speed 233
Paper, rust-preventing, list of makers 74-75b
Petroleum research laboratories..... 307
Pipe
Glass pyrex 91
Impervious graphite 269
Saran lined steel 243
Piping systems B340
Piping systems, insulated, pre-fabricated 257
Plant sites, southeast 294
Power distribution equipment....370-371
Power distribution sytems..... 126-127
Power drives
Bulletin A-60 253
Gear, bulletin LPB 279
Precipitators, electrostatic 296
Preheaters, air 124
Presses, pulp T324
Pressure vessels, corrosion-resisting linings 249
Process equipment 256
Pumps
Acid, bulletin 152 ..... T272
Acid, for brine solutions..... 251
Apportioning, chemical BR392
Centrifugal 23
Centrifugal
Catalog 100 ..... T320
"Close-cupid," bulletin 710.1....301b
Process 381
Single-stage 98-101a
"Supporthead", bulletin 715.1...301a
Type G 372

Page

Cycling jet, bulletin 5030..... 78b
Hydro-pneumatic, data sheet 69A...297b
Impeller, bladeless 98-101b
Pedestal-mounted, bulletin 52B7638..105
Rotating plunger, bulletin L51..... 304
Screw T282
Self-priming, chemical B395
Slurry, type R..... L396
Sump, bulletin 4929 ..... 78d
Triplex
Inverted vertical, data sheet 66..297c
Variable stroke, data sheet 65..297a
Vertical, data sheet 26..... 297d
Triplex or multiplex, direct flow data sheets 64, 64B..... 297e
Refractories
Carbofrax 48-49
Chemical processing 80
Refrigerating machine, absorbent....380
Safety equipment
Gloves, non-slip T328
Goggles 6
Hoods, air-fed L402
Safety heads 326
Scales
Cabinet dial 98-101c
Counting 247b
Printomatic 98-101d
Printweight 247a
Screens
Motor-vibrating 87d
Vibrating deck 52e
Scrubbers & sizing screen..... 52g
Scrubbers, steel paddle mill..... 52c
Seals
Balanced-pressure R335
Bulletin 174CE B332
Separators & stoners 350
Separators
Air 87f
Centrifugal BR394
Signals 128-129
Sintering machines 295d
Snubbers, exhaust 36
Speed & motor reducers, plane torque..275
Speed reducers, worm gear drives, bulletin 135 109
Spray nozzles T226, 405

Page

Steam traps
Bucket 191
Freeze-proof T238
Impulse 239
Inverted, open float..... 213
Strappings & seals BL402
Stuffing boxes, pump, bulletin S-147 ..... TR404
Sulphur 42
Tank drag 52d
Tank cars, all-welded..... 417
Thermal insulation blocks, high temperature 390b
Towers
Cooling 94-95
Cooling, water 50b
Trucks
Dump, Payloaders 367
Electric 89
Tubes, flow, type V..... 325
Tubing
Alloy steel 67
Alloy, welded 308
Condenser & heat exchanger, copper-based 22
Flexible bronze seamless..... 334c
Flexible stainless steel..... 334d
Integral finned 113
Straight-chromium stainless steel..24-25
Turbine agitators 132g
Turbines
Drives, multi-stage, Bulletin GEA-5580 106-107
Steam TR400
Type E, book B-3896..... 43
"Utiliscope", wired television, camera 38
Vacuum equipment 54
Vacuum process equipment for acid recovery 333
Vaporizers
Chlorine 204
Dowtherm, bulletin 124..... T284
Valves
Angle, stainless steel..... 56b
Back pressure bulletin 956..... 207c
Check, tilting-disc, bulletin 30..... 90
Control, diaphragm type, bulletin 481 72

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Advertisements

2	22	38	52f	73b	86	105	132e	195b	227	249	B272a	288-289	302	T322	L335	T356	372	390a	BR400
4-5a	23	39	52g	74-75a	87a	106-107	132d	199	229	T250	B272b	291	303	B322	R335	B356	373	390b	L401
4-5b	24-25	40-41	53	74-75b	87b	109	132c	200	230	B250	B272c	292	304	323	336	357	374	391	M401
4-5c	26	42	54	74-75c	87c	111	132f	201	231	251	B272d	293	305	T324	T338	359	375	T392	R401a
4-5d	27	43	55a	74-75d	87d	112	132g	202	233	252	273	294	306	B324	B338	360	376	BL392	R401b
4-5e	28-29a	44	55b	74-75e	87e	113	134	203	235a	253	274	295a	307	325	339	361	377	BR392	L402
4-5f	28-29b	45	57	74-75f	87f	114-115	175	204	235b	256	275	295b	308	T326	T340	362-363	378	393	TR402
4-5g	28-29c	46	58	74-75g	88	116	179	205	235c	257	276	295c	309	B326	B340	364a	379	T394	BR402
6	28-29d	47	59	74-75h	89	117a	181	206	235d	258a	277	295d	311	327	341	364b	380	BL394	TL402
7	28-29e	48-49	60	74-75i	90	117b	183a	207a	235e	258b	278a	295e	312	T328	344a	364c	381	BR394	BL402
8	30	50a	61	74-75j	91	117c	183b	207b	235f	258c	278b	296	315	B328	344b	364d	L382a	L395	L404
9	31a	50b	62	74-75k	92	118-119	183c	207c	235g	258d	278c	297a	317	329	344c	364e	L382b	R395	TR404
10	31b	51a	63	77	93	120	183d	207d	237	259	279	297b	T318	T330	344d	365a	R382	L396	BR404
11	31c	51b	64	78a	94-95	121	185	213	241	260	280	297c	B318	B330	344e	365b	383	LB397	405
12	31d	51c	65	78b	96	122-123	187	213	242	262	281	297d	319a	331	345	365c	384	R397	417
13	31e	51d	66	78c	97	124	189	214	243	263	T282	297e	319b	T332	346	365d	385	L398	L436
14	31f	51e	67	78d	98-101a	126	191	217	245	264	B282	297f	319c	B332	347	365e	386a	R398	M436
15	31g	51f	68	79	98-101b	126-127	192	218	T246	265	283	297g	319d	333	348	366	386b	TL399	TL437
16	31h	52a	69	80	98-101c	128-129	193a	219	B246	266-267	T284	299	319e	334a	350	367	386c	BL399	BL437
17	34	52b	70	81	98-101d	130-131	193b	221	247a	269	B284	300	T320	334b	351	368	387	R399	R437
18	35	52c	71	82-83	98-101e	132a	194	225	247b	271	285	301a	B320	334c	353	369	388	L439	439
19 20 21	36	52d	72	85	102	132b	196a	226	248	T272	287	301b	321	334d	355	370-371	389	TR400	440
	37	52e	73a																

Editorial Items

176A	178D	180D	180J	184B	186C	188D	192B	194C	197B	198D	202C	204D	204I	205B	206G	208L	209B	209O	209L
177A	178E	180E	182A	184C	186D	188E	192A	194D	197C	199E	202D	204E	204J	205C	205H	205M	209C	209H	209M
177B	178F	180F	182B	184D	186E	188F	193B	196A	198A	200A	204A	204F	204K	205D	205I	208N	209D	209I	209N
178A	180A	180G	182C	184E	188A	190A	194A	196B	198B	202A	204B	204G	204L	205E	205J	208F	209E	209J	209P
178B	180B	180H	183D	186A	188B	190B	194B	197A	198C	202B	204C	204H	205A	205F	205K	208A	209F	209K	209Q
178C	180C	180I	184A	186B	188C	192A													

Card Expires February 15

	Page
Diaphragm, motor	114-115
Gate	
Aloyco	15
Bronze	59, 77
Flanged end	258c
Stainless steel, 150 lb.	258a
Stainless steel, 200 lb.	258b
Globe, stainless steel	56a
Pinch, rubber	B330
Plug	
Bulletin 647	271
Corrosion-resistant	355
Lubricated, catalog 39-5	311
Porcelain, chemical	46
Pressure reducing	
Self-contained, bulletin 966	207d
Single seat, bulletin 950	207b
Streamlined, bulletin 962	207a
Reducing & regulating	BR404
Swing check, corrosion-resistant	258d
Washers	
Log	52f
Pulp	4-5f
Water treatment	
Cold process water softening	259
De-ionizers	303
Demineralizers	309
Hot-lime zeolite process, bulletin 58	125
Ion-exchangers	58, 82-83, 202, 273
Strainers, raw water, flo-clear	261
Up-flow unit, hydro-treater, bulletin 9041	203
Well water supply units	L426
Wire cloth	206

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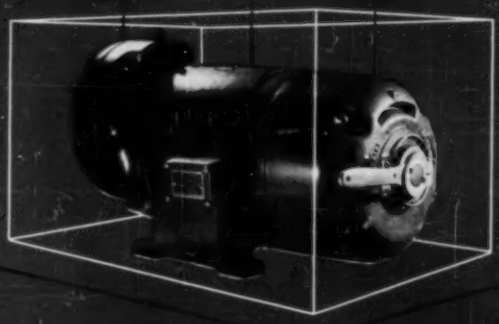

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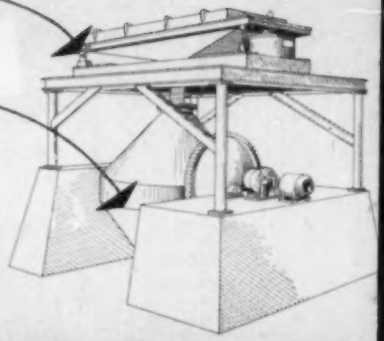

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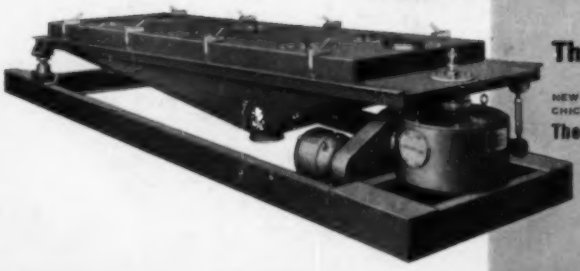

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